ENGINEERING NEWS

BILLS have been introduced into both houses of the New York Legislature incorporating the New York and Hudson Valley Aqueduct Co. to furnish pure and wholesome water from the Adirondack region to the cities of New York and Brooklyn as well as to any of the intermediate places which may desire to come into the scheme. The company starts out in a modest way with a capital of $60,000,000, and wants the State to empower it to acquire by purchase or condemnation, any land or water rights in the Adirondack region above Glens Falls, except those in Lake George, Schroon lake and river and a few other points. The company wants to construct such dams and reservoirs as it sees fit, and to build such canals and aqueducts and appurtenances therto as it may deem necessary to bring the water thus collected to New York, Brooklyn and intermediate points.

This canal or aqueduct is to be commenced within five years after the passage of the act and to be completed to New York within ten years thereafter, failing in which the State may take and finish the work.

Among the thirty-three incorporators are A. P. BOLLER of New York and PETER HOGAN, of Albany, civil engineers.

Engineers looking for a "job" will do well to apply early and avoid the rush.

THAT the workings of the average jurvman's mind are past finding out is proverbial. This was illustrated again in the case of the coroner's jury which "sot" on the two men killed by the accident near Morrisburg, Ont., illustrated in the last issue of ENGINEERING NEWS, April 30. The accident was caused by the giving away of an abutment of a small bridge in consequence of the scouring action of the stream. It will be remembered that the abutment originally stood in a pond, but by the removal of a dam the slack water was changed to a running stream.

The masonry inspector of the railroad company testified that he had examined the bridge last fall and it was then all right, but he did not know the depth of the foundation of the abutment. The iron bridge inspector had examined the bridge the day before the accident and also after the fall and was certain nothing was the matter with the iron work. The assistant engineer on the section had examined the structure very carefully last fall. He did not know how deep the abutment foundation was. "A different abutment is made for a force of water than for dead water."

"*The stone work had to give away before the girders gave away.*" The section foreman crossed the bridge the previous afternoon and took a look at the water which "was about 4 ft. on the stonework. There was quite a current." The other abutment had been repaired last year because "the water had washed the mortar out and made a hole about half a foot deep." This witness had "heard Mr. NASH say that if the dam went away the bridge would be in a bad shape. He said they might better put up the dam as the bridge would go some day."

After duly considering this evidence the twelve good men and true, returned the verdict" that W H STEWART and J. CLARKE came to their death accidentally BY THE CARS BREAKING THROUGH THE BRIDGE OVER NASH'S creek near Morrisburg!"

THE London *Railway News* commends the promoters of the American Exhibition, to be opened next Monday, for the energy they have shown in carrying out their plans in the face of a notable lack of interest in their proceedings by the people of the country they are supposed to represent. The *News* says that a foreign Government could hardly be expected to hold an exhibition on foreign soil, and hence the matter was left in private hands, and has been carried out without official support. The *News* believes these gentlemen have done a good thing for the two countries, in a business and social point of view, and foretells a great success for their venture.

THE Baltimore & Ohio has at last given in on the brake question, and the Westinghouse automatic brake is to be put on all their cars. They have for years been using the Loughridge air brake. The contract is one of the largest of the kind ever given out, and perhaps was not entirely unconnected with the Republic disaster as well as with the unpleasant attitude in which the Boston & Providence was placed by the absence of automatic brakes at the Bussey bridge catastrophe. The New York Central was converted in a still more forcible way by an accident on its own road. The Baltimore & Ohio has shown wisdom in not waiting for sharper reminders.

THE Boston express on the New York & New England R. R., leaving Grand Central depot at 3 P. M. on Friday, April 29, was equipped with F. D. Wilder's steam heater. This heater is a device for warming the circulating water in the Baker or other similar heater by steam from the locomotive. In this test, as only a small amount of steam was needed, the exhaust from the Westinghouse air brake was used. It is generally intended, however, to take steam from the boiler through a reducing valve, or perhaps utilize the waste from the safety valves.

Under each car is placed a drum, about 5 ft. in length and 9 ins. diameter, containing a coil of pipe connected with the steam pipe from the engine. The drum itself is connected with the hot water pipes of the Baker heater, and as the circulating water passes through the drum it is heated by the steam coil. The temperature in the car is regulated by turning a cock which controls the amount of steam admitted to the coil. The condensed water is disposed of by a trap.

The manifest advantage of Mr. WILDER'S system is that it is both independent and continuous, and utilizes as radiating surface, heaters already in use. Whether in newly equipping cars, it is advisable to occupy valuable space with an independent heater and to pursue the somewhat roundabout course of heating a hot water system with steam rather than to turn the steam directly into the radiators, is a matter which may be open to discussion.

SOMETIME ago a report was published in these columns, of a test made of the "Giant" American Portland Cement by Mr. HENRY FAIJA, one of the leading English authorities on cement. This test made the "Giant" Portland "fully equal to the best brands of English Portland cement." As a direct result of this favorable report, last week a lot of this American Portland was shipped to England on the official order of Mr. W. JACOMBE, Chief Engineer of the London & South Western Railway for use on his road. This is another case of "carrying coals to Newcastle."

A SOLID argument, of national import, is being used to choke off the local opposition to the proposed and very necessary sewage-ship-canal scheme of Chicago. And that is the fact that we have no ship entrance to the lakes in case a foreign war should require the presence there of something more powerful than the one antiquated old war-tub that the existing treaty permits us to retain.

SAN Francisco papers are responsible for the statement that a party of Californians are "about to get" the much discussed contract for draining the City of Mexico, with "a six-mile tunnel to cost $8,400,000". No names are given, and whether these parties *will* get it has yet to be decided.

To conform with the "Fisheries," "Healtheries," and "Colinderies" exhibitions at London, the forthcoming American exhibition is already christened the "Yankeries."

A novel train of cars left the Pennsylvania Railroad station, Jersey City, April 21. It consisted of five Pullman cars only, and will be the New York and Chicago limited express on the Pennsylvania Railroad this season. The front end of the first car is for baggage. The center is an elegantly furnished library, filled with extensive bookcases, works of art, handsome upholstery, etc. The rear end is a barber-shop. The second is the dining-car, and in it every modern invention is utilized. The car is finished in carved oak and green leather. Two of the tables can be surrounded by drawn curtains. The other three cars are sleepers, finished in light blue and having all the latest improvements. The cars are all connected by carpeted vestibules, made by inclosing the space between the cars with flexible fabric, the faces of the vestibules being held together by springs. The traveler can go from one end of the train to another on carpeted floors, and not be exposed to the air. Three more trains exactly like this one will be run.

REPORTS from Canada promise an active season of railway building. In 20 years the Canadian railway mileage has increased from 2,400 to nearly 12,000 miles, the Canadian Pacific enterprises forming an important factor in this gain. Before the end of the year this same company expects its lines will be extended about 500 miles into the Provinces of Ontario and Quebec; these include the Algoma & Sault Ste. Marie (86 miles), Montreal & Smith's Falls Air Line (about 100 miles), and Woodstock to Detroit (136 miles). The Quebec & Lake St. John R. R., about 130 miles, is also to be finished this year. In the maritime provinces, the contract has been let for a line through the island of Cape Breton, and a connection between the Intercolonial and the New Brunswick railway systems at Edmundston. Among the probable roads are the Winnipeg & Hudson Bay, the Regina & Long Lake, and Wood Mt. & Qu'Appelle railways.

THE most serious railroad accident of the week occurred May 2, and was due to a derailment on the Atlantic & Pacific R. R. A passenger train left the track and was wrecked. "Several" persons were killed and "several" injured, according to the dispatches.

MORE damage has been done in New England by floods. The Penobscot, Stillwater, Kennebec, Androscoggin, St. Croix, Main, Salmon Falls, Saco and other rivers in Maine; the Merrimac and Contoocook rivers in New Hampshire, the Connecticut river in Connecticut, and the Hudson river in New York have overflowed. Washouts have occurred on the Maine Central, Grand Trunk, and Meriden & Cromwell railroads. Several bridges and two dams have been wrecked, and a large amount of damage done. Earthquakes are reported from California, Arizona, and Mexico; and the embankments of the New Mexico & Arizona Railroad, in Arizona, have neen disturbed thereby. A hurricane occurred in Ohio and Pennsylvania on May 4.

A STRONG movement is on foot to harmonize the various coupler interests—more particularly those of the hook or "vertical plane" type, which seems to be the coming one, and bring about an agreement on some one type. As the mechanical conditions are such that no absolute monopoly can well arise whatever coupler is adopted, since no such adoption will be likely to prevent anyone using another style which will couple equally well with the adopted one, there seems the strongest reason for speedily bringing about such an agreement, especially as it can hardly help to result in a great decrease in the cost of couplers. As conditions are now—with a sharp, incessant conflict between the various patents, no one can afford to sell a coupler for much less than 100 per cent. profit, unless he is to lose money on every one he sells, owing to the selling expenses and small number sold. By doing away with this, a very heavy reduction in the necessary profits to afford a fair return will at once result.

THE full report of the Massachusetts Railroad Commission, which we have received since our last issue, conforms exactly to what we stated of it in our last issue. In some respects it seems to us to say a little too much, and in others somewhat too little, but as a whole, he would be an unreasonable man who should find any more serious fault with it than that it has been very late in coming out. We shall hope to discuss the technical points raised by it more fully in a subsequent issue, our space this week not permitting us to do so.

THE *Bulletin du Canal Interoceanique*, reports a total of 1,654,000 cu. yds. as removed on the line of the Panama Canal in the month of February last. The bulk of this excavation was done at Gatun, Culebra and La Boca; about 612,000 cu. yds. were from the changing of channel in the Chagres river. About 135,000 cu. yds. were removed from the Culebra cut as opposed to 58,300 cu. yds. for the month of January, which had been the largest amount to that time.

The Impediments to Good Practice in Railway Location.

[From the Introduction to the forthcoming Edition of 'The Economic Theory of the Location of Railways," by A. M. WELLINGTON, C. E.].

It would be well if engineering were less generally thought of, and even defined, as the art of constructing. In a certain important sense it is rather the art of not constructing; or, to define it rudely but not inaptly, it is the art of doing that well with one dollar, which any bungler can do with two after a fashion.

There are, indeed, certain great triumphs of engineering genius—the locomotive, the truss bridge, the steel rail—which so rude a definition does not cover, for the bungler cannot attempt them at all; but such are rather invention than engineering proper. There is also in some branches of engineering, as in bridge-building, a certain other side to it, not covered by such a definition, which consists in doing that safely, at some cost or other, which the bungler is likely to try to do and fail. He therefore, in such branches, who is simply able to design a structure which will not fall down, may doubtless in some measure be called an engineer, although certainly not of a very high type.

But to such engineering as is needed for laying out railways, at least, the definition given is literally applicable, for the economic problem is all there is to it. The ill-designed bridge breaks down; the ill-designed dam gives way; the ill-designed boiler explodes; the badly built tunnel caves in, and the bungler's bungling is betrayed. But a little practice and a little study of field geometry will enable any one of ordinary intelligence, without any engineering knowledge whatever in the larger sense, to lay out a railway from almost anywhere to anywhere, which will carry the locomotive with perfect safety, and perhaps show no obtrusive defects under what is too often the only test—inspection after construction from the rear end of a palace car. Thus, for such work, the healthful checks which reveal the bungler's errors to the world and to himself do not exist. Nature, unhappily, has provided no way for the locomotive—like Mr. JINGLE's intelligent pointer—to refuse to pass over an ill designed railway as it refuses to pass over an ill-designed bridge.

Therefore, since there is no natural line between safety and danger to mark even so rude a distinction as that between the utterly bad and the barely tolerable, in the kind of engineering work we are to study, one may fairly say that the locating engineer has but the one end before him to justify his existence as such—to get the most value for a dollar which nature permits; and but one failure to fear—that he will not do so. Except as his work necessarily involves the preliminary design of constructive details, he has no lives to save or imperil; and the young engineer cannot too early nor too forcibly have it impressed upon his mind that it takes no skill worth speaking of to do such work after a fashion, unless in the comparatively few localities (rare indeed in the United States) where to get a reasonable line of any kind is something of a feat. His true function and excuse for being as an engineer, as distinguished from a skilled workman, begins and ends in comprehending and striking a just balance between topographical possibilities, first cost, and future revenue and operating expenses.

While this, in a certain sense, is peculiar to the branch of engineering we are to study, yet a curiously close analogy may be drawn, tending to show that it is as essentially true of all other branches of engineering as of this. For example, it is beyond doubt that the true reason for the striking progress in bridge building in recent years has been, not that men have been driven into excellence by "the responsibility of human life" resting on them; —for, after the types have once been invented, a relatively low order of engineering skill suffices to reduce that risk alone to a minimum. But the impelling force has been the keen competitive struggle to bring the first cost of every bridge as low as possible, and yet do nothing which shall injure its permanent efficiency and compel it to be speedily rebuilt; nothing, in other words, which shall increase the future "maintenance and operating expenses." But whereas the "operating expenses" of bad bridge-engineering come in a series of startling catastropes which shock the community and dismay the moneyed interests concerned, causing good work to be appreciated and insisted on, and scaring off the amateurs and 'prentice hands from "meddling and muddling," after the manner of their kind, the operating expenses from bad railway location come by a gentle but unceasing ooze from every pore which attracts no attention, albeit resulting in a loss vastly larger than any possible loss from bad construction; for it requires some training and experience even to appreciate the loss as existing, and still more of both to appreciate it as remediable. In fact, no one can do so, except in the most general way, without special investigation of each special case. Errors which, even if committed, are not likely to be discovered, are rarely much feared, and at last the consciousness that there is danger of error becomes dulled.

In these facts we have plain reasons why average practice in laying out railways should inevitably tend, as it does tend, to be and remain of a low grade. It is not difficult, in fact, to see reasons why it can never well be otherwise, except in degree, unless the progress of science should wholly change the nature of the work; and a correct appreciation of how great is this danger, and why it exists, will greatly help to save the student from it.

The permanent difficulty lies in this: High efficiency in any art or calling in which many minds of no phenomenal gifts are engaged requires that every man's work should be readily comparable either with a certain uniform standard or with the work of his fellows. In constructive engineering this is possible. Broadly speaking, a 100-ft. bridge is a 100-ft. bridge, the world over. It has everywhere to fulfill but two primary conditions: It must carry a certain nearly uniform load per foot, and it must not fall down. The same is in substance true of every form of constructive engineering. Every man's practice therein, therefore, is comparable, and is compared, with the highest level of practice, the world over. Those most highly skilled are discovered and recognized. The moderately skilled perceive and correct their deficiencies. The hopelessly unskilled retire to other pursuits.

In laying out railway lines, and less strikingly in some other analogous kinds of engineering work, this is forever impossible. We cannot reduce the laws of topography, nor even of finance, to equations and formulæ. Every line is a problem by itself, with its own peculiar physical and commercial conditions, so that the engineer is deprived of the aid to be had by comparing with, and copying the details of, the practice of others. Under these circumstances, the difference of conditions will be apt to be honestly accepted by the reader who may have sinned against good practice, and by all others concerned, as the reasons why another line, one hundred or one thousand miles off, should have cost so much less and yet be so much better worth owning than his own. He who has done well, therefore, is cut off from any absolute knowledge and general recognition of that fact, and the guilty reader, who has done ill, is cut off from the still greater gain which would come to him from a revelation of where and wherein he has done ill. In most such cases each will have in some detail shown better judgment than the other; but from the lack of unquestionable evidence of this, each is denied the instruction which he might otherwise receive from that fact, and so is in great danger of falling into the most natural and most human error, believing that all that he has done is good, which has not been proven to be bad, and so ceasing to make effort to improve upon what is good enough to pass, and merely multiplying errors with advancing experience, without really advancing in knowledge.

For these reasons the student should begin with the consciousness that the level of average practice in railway location, his own included, is by its nature restricted, not to the sum of the united abilities of all those who are or have been engaged in it, as in constructive engineering, but to the average individual level of capacity and knowledge. No more is needed than this undoubted fact to prove to demonstration that average practice is, and must be, both comparatively and absolutely, of a pretty low grade; and hence it becomes every one who may be entrusted with such work to have constantly before him the fact that he stands thus alone, and to scrutinize with the sternest skepticism, the conclusions which he may reach, remembering that his danger of grave errors of judgment is thereby multiplied manyfold. As he measures only by his own knowledge, all the work he does will naturally seem good even if really bad.

(TO BE CONTINUED.)

A New Boiler Feed and Force Pump.

The Lawrence Machine Co., of Boston, Mass., builds a new form of feed and force pump, illustrated herewith, which embodies constructive features that permit the makers to claim it as the cheapest, simplest and best boiler feed in the market.

It is called the WEBBER differential power pump, and the advantages claimed are—the passage of the water straight through the pump unobstructed by corners and short angles; the two plungers are directly in line, one over the other, with the driving gear and connecting rod so guided that there can be no side wear in the stuffing glands, and with its three suction inlets and three discharge outlets, the piping can be most economically taken off with a minimum of elbows. A very important pump defect, which this pump is designed to overcome, is the accumulation of air near the plungers, and consequent break of suction; in the WEBBER pump all air entering the pump *must* pass up through the plunger to the air-chamber.

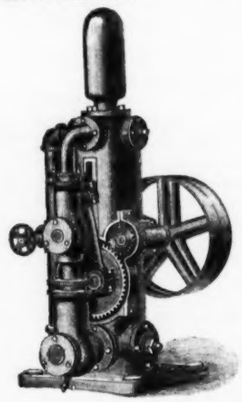


Fig. 1.

Figs. 1 and 2 show general and sectional elevations of the pump. Refering to Fig. 2, it will be seen that the upper pump barrel, and lower plunger (10) are in one piece, carried up and down by the connecting rod (30) which is guided by a slot in the pump frame; the upper plunger (18) is fixed. The driving pulleys

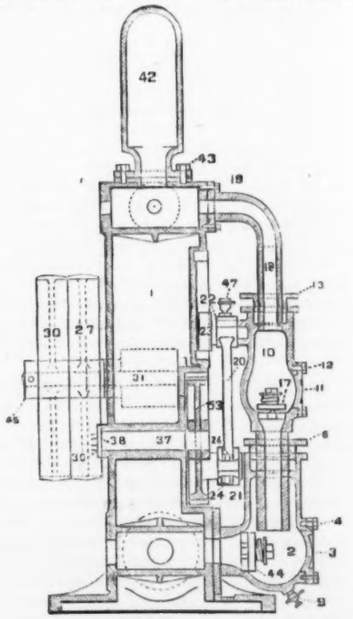


Fig. 2.

(30, 27) are geared to the connecting rod as shown in Fig. 1. Removable covers (3 and 11) permit easy access to the two valves, and the driving mechanism is all outside of the pump, of few parts, and yet covered, so as to be protected from dirt and accident.

Clearance Test Frames on German Railways.

The *Centralblatt der Bauverwaltung* describes some simple little gauges for detecting encroachments detrimental to the safe passage of rolling stock, which may give a useful hint. The clearance limit for rolling stock on German railroads is very circumscribed, especially the head room, and as slight variations in the alignment and surface of the track would in many instances prove dangerous, frequent measurements at close points are required.

As examinations by means of test cars cannot always be made, the apparatus shown in Figs. 1 and 2 has been devised for this purpose and several year's use has proved its entire efficiency.

It is made of planed strips and boards arranged to correspond with the standard clearance section.

Those points of the apparatus which rest upon the rail are shod with sheet iron to guard against wear.

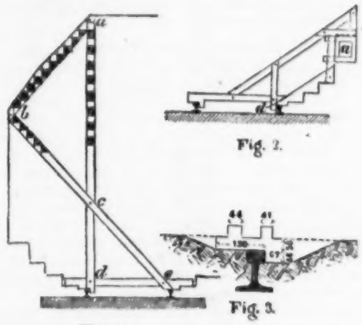


Fig. 1.

Fig. 2.

Fig. 3.

A pendulum, suitably placed or a splint level attached to the lower cross-piece affords a ready method of ascertaining the relative level of the rails.

To provide for variations in the standard sections (that of station yards having the least clearance) the lower position of the frame is provided with a moveable part for this purpose (*a*, Fig. 2). The strips composing the upper portion of the frame (Fig. 1) are so arranged that by slightly loosening the set screws *a c* and *d*, and wholly withdrawing the pins *b* and *c*, they will fold together, thus affording easy transportation from place to place. The combined length of the folded pieces is also the proper height which overhead telegraph lines must clear the track.

The strips are painted and graduated, from which latter the position of any encroachment can be quickly determined. Fig. 3 shows a metal pattern with which watchman test the prescribed clearances for wheels at road crossings.

Reservoir for Railroads, Mills, Farm Use, Etc.

BY S. F. BALCOM.

Reservoirs differ somewhat from mill-ponds. They require less from nature, can be located more nearly where wanted, and are almost entirely artificial. They have come into use not so much from choice, perhaps, as from necessity. In the case of railroads, where reservoirs are most in use, the wells which are usually the first source of water supply, soon become inadequate, and their use is a source of heavy expense. Well water is also objectionable on account of the lime it contains. The quality of the water has a great deal to do with the cost of maintenance of boilers, as will appear from the fact that the alkali in the water of some western states will render the flues unfit for use in the short space of six months, while on the other hand, a set offlues on the Southern Division of the Illinois Central R. R. where surface water is used, have been known to last fifteen years without repairs. But the main cause of the introduction of reservoirs was the inability of wells to furnish the required amount of water at all times and seasons. The amount required has also steadily increased, for while a locomotive some years ago consumed from 1200 to 1500 galls. of water in running 25 miles, they now use from 1500 to 3000 galls. in going the same distance. The extra amount is made necessary by the increased number of loads that are now hauled in a train, and the increased weight of the loads from 10 tons to 15 and 20 tons per car.

One of the first reservoirs built on the line of the Illinois Central Railroad was at South Neoga Tank It had a capacity when built of about 4,000,000 galls. Reservoirs have also been excavated at Kinmundy, and at the first station north of Mattoon. These, with water from Crooked Creek and Little Wabash river, give surface water for passenger engines between Centralia and Champaign, except at Champaign, where only a partial supply of surface water is had.

Twenty years ago there were sixeeen water stations between Champaign and Centralia, a tank for every eight miles. At nine points the water was pumped by windmills or by hand, at three places by horse-power, and at four stations by steam. These sixteen water stations have been reduced to six and the pumping is done by steam. They are now an average distance of twenty miles apart, instead of eight miles as formerly. The standard tender on the Illinois Central Railroad has a capacity of 3,000 galls., and as soon as all locomotives are supplied with tenders of this capacity the average distance can be made still greater, although the rate of consumption will probably continue to increase.

During the severe drouth of last season the reservoirs on the section of road just named partially failed; but by taking water at Mattoon, furnished by the City Water Co., and in some cases using double tenders, the road was able to handle its business.

In the construction of reservoirs the location desired is one that has a sufficient water-shed to furnish the required amount of water; also one that has a natural basin, in order that when the water is confined it shall not back up on or overflow adjoining land. It should, of course, be as near as practicable to the supply tank, so that the cost of pipes for conveying the water from the pump would not be too great. The Illinois Central Co., however, conveys water in this way at Little Wabash river nearly one and a half miles, and at Crooked creek about two and a quarter miles; and at Anna, in Union county, the water is pumped from a spring and forced about one-half mile to a tank on the top of a hill, from whence it gravitates through pipes to the supply tank at Anna station, a distance of about one mile.

The cost of excavation will depend on the nature of the earth at the point where the reservoir is located. Examination should be made if stone or beds of gravel are liable to be encountered. The cost of excavation at South Neoga in 1869 was about 22 cts. per cu. yd.; and at Kinmundy in 1885 the cost was 19½ cts. per cu. yd. The reservoir last mentioned was formerly a second or third-class water station, the supply being furnished by a well and the pumping done by windmill and by hand. It has within the last two years been made a first-class water station, a reservoir of nearly 2,000,000 galls. capacity having been excavated, a brick engine house built, and a new tank or tub erected. In constructing the latter, which is some 700 ft. from the pump house, a new plan was adopted, that of setting the tank, which is placed on open framework, back some 50 ft. from the track, and of supplying the locomotive tenders by means of pipes and a penstock. Taking the expense of constructing this water station as a basis, a fair cost of water supply can be arrived at. The cost of the reservoir at Kinmundy, however, was only one-half the following estimated, as it contains but 2,000,000 galls., while a standard reservoir should contain at least 4,000,000 galls.

COST OF A FIRST-CLASS WATER STATION.

Reservoir		$3,000.00
Plant:—		
Engine house, tank and penstock	$1,950.00	
Machinery and pipes	750.00	2,700.00
Total amount invested		$5,700.00
Interest on investment at 6 per cent	$ 342.00	
Depreciation and expense of plant at 5 per cent	135.00	
Wages of pumper	420.00	897.00

ESTIMATED AMOUNT OF WATER USED.

Three passenger engines and seven freight engines each way daily, equivalent to twenty tenders of 2,000 galls. = 40,000 galls. daily = 13,600,000 galls. per year.

The expense at that rate is about 6⅕ cts. per thousand galls. The rate paid at Mattoon as mentioned was 17 cts. per thousand galls. It was a temporary supply however.

In order to make use of the banks formed around reservoirs by wasting the earth excavated, the dam at outlet in some cases has been kept high. This backs the water up in rear of reservoir, and unless there are banks each side of the inlet, the water floods adjoining lands. If the reservoir is located in low, swampy or flat grounds, the water could not well be confined between banks in this way, and the consequent overflow would be liable to cause trouble. In such cases, the following plan is suggested: Build a dam, designated for convenience, a "retaining wall," at the inlet or point where the water enters the reservoir. This should be of the same height as the dam at the outlet where the overflow water is discharged. In this retaining wall, build inlet boxes or pipes having slide gates or valves. If boxes are used, they should be placed one above the other, securely framed together and made water-tight. Wings should be extended into the retaining wall on each side, so that there will not be any posibility of the water forming a break in the dam at the sides of the inlet boxes. This furnishes an inlet for the water at various heights from the bottom of the inlet to the top of the retaining wall. The valves should be placed on the inside of the inlet next to the reservoir, and hinged on the top, so that they will swing in towards the reservoir. This will allow a free inlet for water coming to the reservoir. The valves should also be so arranged that when the backwater at the inlet is drawn off, the weight or force of the water in the reservoir will force them down or back into place and prevent the escape of the water in the reservoir. If pipes are preferred to boxes, they can be arranged in the same way, being laid in mason work. In order to carry off the back water at the inlet that causes trouble by overflowing adjoining land, lay an ordinary tile drain of the required capacity, beginning at the bottom of the inlet and outside of retaining wall, then passing round and outside of reservoir, and ending at outlet and outside of the overflow dam. The object of this drain as stated, is to carry off the backwater. As soon as the rush of water subsides, the drain will begin to lower the water in question, which will cause the water in reservoir to close the valves in the inlet boxes, and retain a full supply of water in the reservoir. The time required to carry off the backwater, will depend on the amount of water and size of pipe, which can be ascertained and provided for.

Reservoirs are needed for mills or manufacturing purposes as well as for water supply on railroads, and would be very valuable for farm use in supplying water for stock, for growing fish, and for furnishing ice for summer use.

In farms where creeks or large ravines can be made use of, a reservoir could be constructed by simply building a dam, using earth from the proposed location for grading the embankment that forms the dam.

A very good plan for a dam, in such a location, is to set a row of posts in a trench dug crosswise of the stream, so that the tops will form the crown of the dam. The posts or logs should be dressed, so they will set close together. The tops of those in the center should be level for a distance of about 6ft., then raise each way to the banks on each side, forming wings to the dam. An embankment is then formed on each side of this row of posts; that on the inside being graded to a slope of 1 in 3, and that on the outside about 1 in 15, or as long a slope as may be practicable. Then at the crown of the dam, on both sides of the posts, fill in and tamp solid as much stone as practicable. The row of posts will break the cutting force of the current at time of overflow, and hold the stone in place, and together with the stone will prevent any washing at the crown, which is the weak point in a dam or embankment of this kind. A dam built in this way at Crooked creek, one of the water stations already referred to, has stood for years, while others that were previously built there of timber and earth failed.

When reservoirs are used for farm purposes care should be taken and measures adopted to prevent stock from getting into the water; for the water should not be allowed to become stagnant, and this can only be done by keeping it clean. If shallow water becomes filled with vegetable matter and other impurities it becomes stagnant.

Reservoirs should have steep sides, and have at

*From Transactions of the Illinois Society of Engineers and Surveyors.

least five feet of water when new. Trees and bushes can be planted near or on the banks, and although they will draw somewhat on the supply of water still they will probably render an equivalent in the satisfaction and pleasure found in having at hand a veritable lake and park of one's own; and, if desired a row-boat can be added and a stock of fish supplied, and pleasures not often to be had on the prairie are at hand.

Brick Street Pavements.

Mr. GEO. F. WIGHTMAN, of Peoria, Ill., says that brick has been used for street pavements in Bloomington, Galesburg, Jacksonville, Chicago and Peoria, and has shown remarkable qualities of endurance. The all-important requisite is to obtain brick of a uniform hardness, and the experience of the writer warrants him in the conclusion that but few localities supply clay which will stand without fusing the degree of heat necessary to make a brick hard enough for street pavement. Such brick has been made, however, in Bloomington and Ottawa, in Illinois, and in Haydenville, Ohio; and some of these pavements after 10 years use still show a uniform, smooth surface, with no repairs worth mentioning.

The usual method of laying this pavement is as follows:—Excavate to, say, 10 in. below the grade-line; roll and solidify the foundations as required in the specifications for Macadam; then cover with a 4-in. layer of sand. Lay the first course of brick flat upon this sand and lengthwise with the street, breaking joints. Tamp this layer down solidly and fill the interstices with sand well swept in; spread on this first layer of brick another layer of sand 1 in. deep carefully smoothed. On this sand set a course of brick on edge, crosswise of the street and again fill the joints with sand; cover the whole with a layer of sand 1 in. deep, and the street is ready for travel.

The brick used in this upper layer must be burned to a flint hardness, and be uniform in this hardness; otherwise the street will soon present an irregular surface as a result of unequal wear. The cost of this pavement depends largely upon the facilities for obtaining the requisite material. With conditions equal it should not cost more than $1.50 per sq. yd., with gravel streets costing 75 cts. and Macadam, $1.15 per sq. yd. This $1.50 includes all expenses from the survey to the completion of the street for use.

As with any other material, these brick pavements must be well cared for, though they require much less work than gravel or Macadam. Brick pavements are being laid better every year, as the brick manufacturers improve in the quality of their products, and introduce new methods and machinery. Specimens of the Bloomington brick in use for 14 years showed not over a half-inch wear in this time.

In Nashville, Tenn., a creosoted brick has been tried, with a view of rendering it less absorbent, and in Wheeling, W. Va., a truncated brick made of clay and iron-slag is used; but no details are given for either as to service under traffic. A brick pavement on Pine St., St. Louis, under the severest wear for two years, showed $\frac{1}{8}$ in. wear per year. As a whole, this makes a pretty good record.

Disposal of London Sewage.

Mr. BAILEY DENTON, M. Inst. C. E., has been reading a paper on this subject at the Parkes Museum, London. In referring to the money value of town sewage, the speaker differed from the old estimates of BARON LIEBIG and BOUSSIGAULT, putting this value at 6s. 8d. per annum per ton; he rather agreed with Mr. J. CHALMERS MORTON, of the Rivers Commission, that 5s. per ton was nearer the truth. He objected strongly to open collecting tanks and their position in the midst of a dense and rapidly growing population, as just adopted by the Metropolitan Board. He said that it was impossible to there utilize any of the fertilizing properties of the vast volume of sewage, and said that they should have extended the outfalls further down river, beyond Hale Haven, as recommended by the recent Royal Commission on Sewage Discharge. The sewage of the present four millions of Londoners was sufficient to fertilize the nine southern counties of England and would be wasted under present plans.

Mr. DENTON charges that the Metropolitan Board has wholly disregarded the utilization of sewage, and then advocated at some length the intermittent filtration and wide irrigation systems of sewage application, or both combined as better still. In referring to the continued pollution of the Thames, the speaker called attention to the fact that while the upland flow of the Thames may be as little as 750,000,000 galls. in 24 hours, the quantity of sewage discharged in the same time may be 160,000,000 galls. or more than one-fifth the amount. The least proportion of sewage recognized as safe for riparian interests is one-twentieth, or 5 per cent.; and this one condition is considered by Mr. DENTON as sufficient to condemn the present scheme.

George Washington, Land Surveyor.

Prof. HEBERT B. ADAMS, of JOHNS HOPKINS University, in a sketch of William and Mary college, for the United States Bureau of Education, refers to Washington as a surveyor. The land system of Virginia was early placed in the control of the college authorities, who appointed the surveyor-general and all county surveyors. In 1749, William and Mary college gave such a county certificate to George Washington, then only 17 years of age; and this, the equivalent of a degree in civil engineering, says Prof. ADAMS, gave a peculiar bias to Washington's life, before and after the Revolution. His early practical career as a surveyor of land, made him first favorably known to influential Virginians, for competent men were scarce; this led to his appointment as a militia officer in the defence of the Virginia frontier against French encroachment, and his intimate knowledge of this back country, acquired as a surveyor, led to his diplomatic commission to the French posts in the Ohio valley. From this expedition of Washington, at the age of 21, when he surveyed French forts, and French schemes, with all the skill with which he had formerly surveyed land, proceeded the entire train of English policy leading to war with France. This frontier war established the military reputation of Washington, and finally made him commander-in-chief of the Revolutionary army, and the first President of the American Republic.

English Mines in 1886.

The Home Office of England reports as follows upon the mines and miners of England for the year 1886:—The total coal output was 157,518,482 tons; iron-ore, 8,862,648 tons and fire-clay, 3,625,829 tons; the grand total being 170,006,959 tons. This total mineral output has been falling off since 1882; the record standing in round millions as follows: 1882, 171; 1883, 179; 1884, 175; 1885, 173.

The death rate in coal-mining operations was less than in any previous year excepting only 1884 and 1876; this rate for 1886 being 1.833 per 1000, as compared with 2.207 in 1885 and 1.810 in 1884, while the average death-rate for the previous ten years, 1874–83, was 2.238. There were 953 deaths last year, or one in every 545 employed, whereas the average for 1874–83 was one in 446, and in 1885, one in 453. The summary shows that 210,665 tons of mineral were obtained for every fatal accident. Another summary shows that coal-mining is fully twice as safe as it was 30 years ago, as in 1851 one person in 219 employed was killed. Taking this average by decades, in 1851–60 it was 1 in 245; 1861–70, 1 in 300; 1871–80, 1 in 425; the present decade is a long way ahead of its immediate predecessors.

Under the head of people employed we find a total of 561,092 in 1886, as compared with 595,190 in 1874; the average for the ten years 1874–83 is 557,650. In this latter average we find 8,186 females, though this number is reduced to 5,568 in 1886 as against 11,035 in 1874; 448,657, in 1886, were employed underground, 311 being between 10 and 12 years; 3,697 being between 12 and 13, 36,480 between 13 and 16 and the remainder above 16 years of age. All the females are now at work above ground.

The causes of death in 1886 were as follows: Explosions of fire-damp, 129; falls in sides and roof, 461; shaft accidents, 86; miscellaneous underground, 188; on surface 89; 11 deaths resulted from overwinding and one through the breakage of rope.

Arizona Irrigation Law and Demands.

The Governor's message to the Arizona Assembly for 1887, calls particular attention to the importance of the control and application of the natural water supply of that section. Article 22 of the Bill of Rights reads: All streams, lakes and ponds of water capable of being used for the purpose of navigation or irrigation, are hereby declared to be public property; and no individual or corporation shall have the right to appropriate them to their own private use, except under such equitable regulations and restrictions as the Legislature shall provide for that purpose." By Territorial Statute, Sec. 1, Chap. LV, Compiled Laws, it is enacted "All rivers, creeks and streams of water in the Territory of Arizona, are hereby declared public, and applicable to the purposes of irrigation and mining." In Sec. 3 of the same chapter, it is declared that: "All the inhabitants of this territory who own or possess arable and irrigable lands, shall have the right to construct public or private *acequias*, and obtain the necessary water for the same from any convenient river, creek, or stream of running water."

As the right of appropriation of water for irrigation and mining is thus granted, the Governor suggests that the thing needed is a law clearly defining the manner of appropriating, regulating and distributing the water supply, with no uncertainty as to rights and privileges. Capital should be protected in all its vested rights, and capitalists should be encouraged to build canals and irrigation ditches; but while these men should receive fair returns for their investment, extortionate charges upon dependent land-owners should be made impossible. Gov. ZULICK believes that the Territory should never surrender the absolute control of its water supply, but fix reasonable charges for its use so as to both protect capital, prevent exorbitant charges and prevent waste in distribution.

The Governor again directs attention to the importance of an appropriation by Congress to test the practicability of artesian wells and water storage reservoirs in the Territory. He believes that a hydrographic survey would demonstrate with reasonable certainty the districts best adapted to such development, and that if desert lands can be reclaimed by artesian wells, private capital will soon make them productive. As Arizona has no rivers or harbors to absorb annual appropriations, like the majority of the States, and as the title to these lands lie in the Government and they are valuable only when watered, there are reasonable and economical reasons for a generous appropriation to this end by the general Government.

Plaster Flooring in the Midlands.

The coarsest description of gypsum is used, and after calcination is broken with wooden flails. It is kept in a dry state, and when laid is mixed with water to the consistence of rough mortar, and spread over the wood joints on reeds or laths to a uniform thickness of 2 in. to 2½ in. It hardens very rapidly, and the workmen use a long float of wood for levelling it, and on the second or third day it is polished off with boulder stones or trowels. It is desirable that the surface should not be broken by using the floors too soon after they are laid; it is also usual to give an increased hardness by a coat of linseed oil, and in Nottinghamshire the floors are painted, and look extremely well. Two sides of the room have wood fillets laid down, varying in thickness with the superficies of the floor, which, being removed immediately after it is laid, allow for the expansion, which is not only very considerable, but continues for some time. Floors of this material are very strong, and are extremely well suited for cottages, being in this district much cheaper than inch white deal. The under surfaces of the joints are edged, and sometimes planed, and the ceiling is formed by the plastering of the reeds between the floor timbers. These floors are to a certain extent fireproof, and, having a smooth surface, are easily cleaned, and afford no harbor for vermin; on these accounts, as well as for their cheapness and durability, plaster floors, as they are called, are almost invariably adopted in the Midland counties, where the carriage of the material does not operate as an objection.—*The Architect.*

TESTING BRIDGES.—The strength of railroad bridges should be tested at least once a week by running over them a heavily loaded freight train carrying all the watered stock, the commissioners, construction contractors, president and officers of the road. If the bridge goes down that settles it.—*New Orleans Picayune.*

The Rasmussen Cable System.

The device illustrated is the invention of C. W. RASMUSSEN, of Chicago, Ill., patented 1882-85, and further improved by patents granted to Mr. H. W. McNEILL, of Oskaloosa, Iowa. It is about to be put down at Sioux City, Iowa.

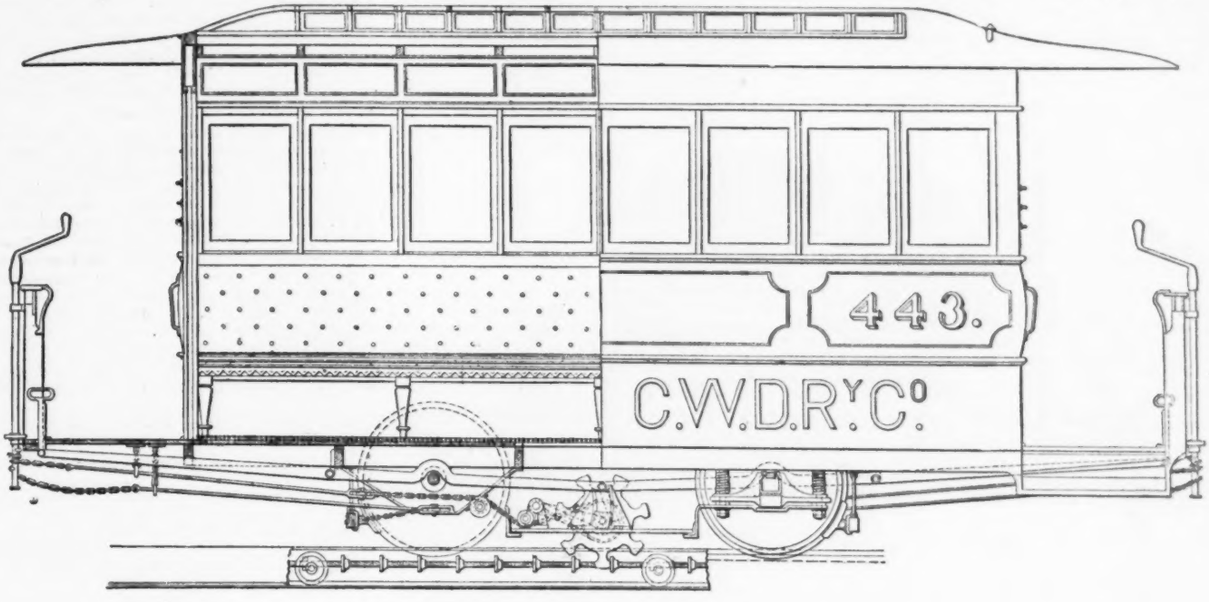


Fig. 1 The Rasmussen Cable System.

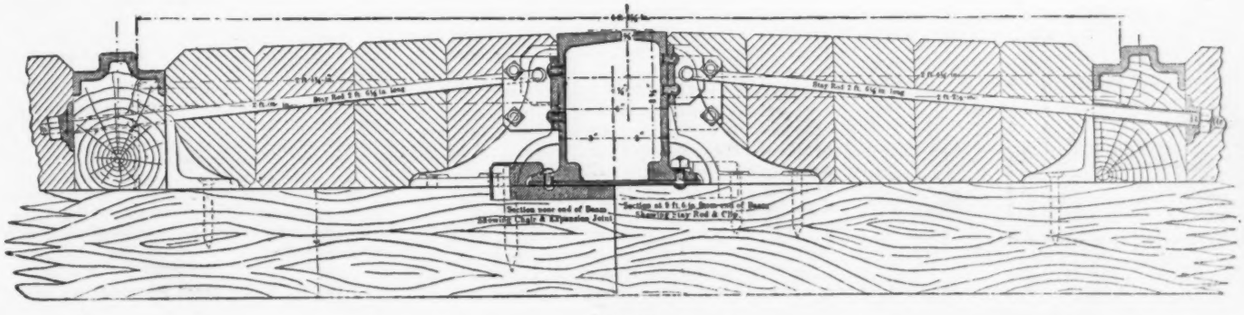


Fig. 2.

Fig. 2 illustrates the cable-tube, 7½ in. deep by 6 in. wide made as shown; this tube is built in sections of 30 ft. and the ends are fitted together in cast-iron chairs and at these joints -shaped pieces are riveted to provide for expansion and contraction. The cable-trucks are two-wheeled, 6 ins. in diameter, made of cast-steel, and are spaced about 6 ft. apart, and run on two tracks inside the tube.

The cable is made of steel wire, is about 1 in. in diameter and on it are fastened, by compression, at intervals of 8 in., cast-steel buttons, 3½ in. diameter and 1 in. face: every 6 ft. one of these buttons is enlarged so as to form a journal-box through which passes the axle of the two-wheeled truck before referred to. Horizontal curvature is made by the use of sprocket or arm-wheels of small diameter, as shown in Fig. 3; vertical curves are provided for by upper and lower tracks in the tube upon which the small trucks can ride.

The car (Fig. 1) is provided with an 8-armed sprocket-wheel of cast-steel, as shown, and furnished with a flange projection on one side to carry a strap-brake. The eight arms of this wheel are pitched so as to mesh in with the buttons on the cable and the arms project down 5 in. below the top of the tube-slot. The axle that carries the sprocket wheel is carried by two 2x½ in. iron bars attached to the journals of the car axles proper; these bars are bent down to within 3 in. of the track, and inward until they are 12 in. apart at the center line of the car. On the frame made by these bars are carried the journals of the sprocket-wheel, and these journals can slip up and down 7 in. in guides provided. If left alone in these journals the sprocket-wheel would simply turn as fast as the cable would drive it without moving the car; but one end of the strap-brake is attached to the car and the other end to a bar-lever from which a chain runs to a winding post at each end of the car.

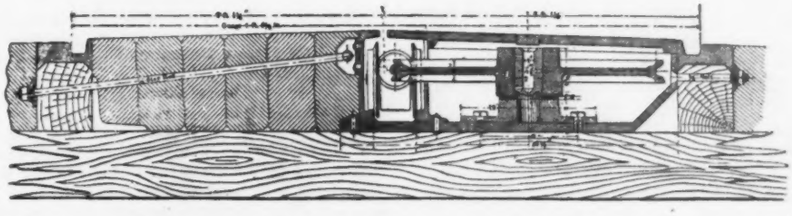


Fig. 3.

To move the car the driver tightens up his hand-wheel, thus putting on the strap-brake and arresting the motion of the sprocket-wheel and the arms engaging with the buttons on the cable the car must move forward as soon as all motion in the wheel ceases. To stop the car, he releases the strap and brake puts on the car brake at one time.

The advantage claimed by the inventors over other systems are—the adaptability of this sprocket wheel to every car, whereby it may be utilized as either a cable or an ordinary horse-car, and only 200 lbs. weight is added to the car; and the further claim is that there is no friction wearing point anywhere upon the cable, and that its life can be safely put at 10 years; it requires no skill to run it, and somewhat noisy in its working. Excluding engine house, cars, street track and paving the estimated cost of a first-class plant for heavy city traffic is $20,000 per mile, with $15,000 per mile for smaller towns. We are indebted to the *Iron Age* for the originals of the above illustrations.

TELEPHONE wires in Germany are generally made of steel, being considered more durable when of this material. This supposition was fully confirmed after the recent memorable snow storm, as steel wires were found to have scarcely suffered any injury. The results of the investigations of the general authorities on the matter of telephone wires, occasioned by the same snow storm have just been published. It is found that phosphor bronze wires are of but little worth; steel showed very favorably results, but those of silicium bronze were proved to be very far the best in every way.

The Autographometer.

Le Génie Civil contains an illustration, and description of the "autographometer" invented by M. FLORAN, and intended to plot to a fixed scale the topography and levels of any given country. We give the following brief account of this machine:

The mechanism is arranged so as to automatically plot the length of straight parts of roads, and the angle of any change in the direction of such roads, and it also records a true profile of the route followed. The whole apparatus is enclosed in a rectangular casing resting upon three wheels, as shown in Fig. 1, and can be drawn over any road either by a man or a horse, as found desirable.

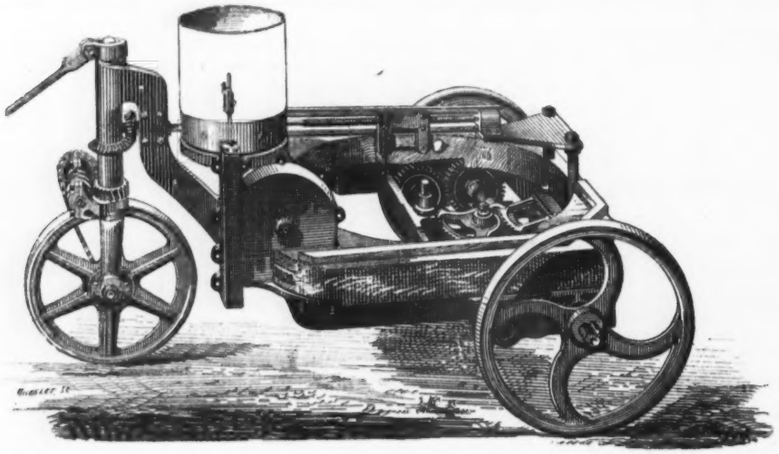


Fig. 1. The Autographometer: General View.

Describing the topographical part first, and referring to Fig. 3., the front wheel R'' is free to turn in any direction; the rear wheel R is keyed upon the axle E, and the other wheel R' is keyed upon a sleeve on this axle, ending in the toothed pinion G. The axle E has a screw cut upon it at the center, and a false axle E' parallel to it is provided with a similar screw, and carries the gear-wheel G' of the same diameter as G and gearing with the latter. A helicoidal wheel I gears with the threads of the axles E and E'; upon the axis of this wheel I, is mounted a sector K with double cycloidal teeth engaging on the one side with the pinion P, and on the other with the rack U.

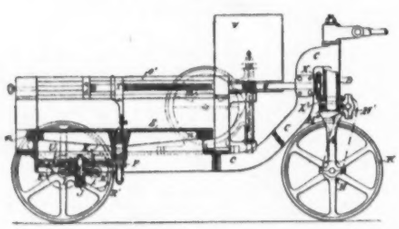


Fig. 2. Longitudinal Section.

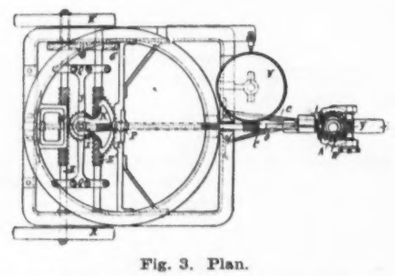


Fig. 3. Plan.

Upon the pinion P is mounted a circular horizontal plate S (Fig. 2) resting upon friction-rollers n. The vertical axis of the front wheel R'' carries a small coned pinion X' gearing into a similar pinion X terminating in a small horizontal threaded shaft O which works at will upon a small cross-head T carrying a pencil.

The pinion X' is fixed to a helicoidal wheel H' gearing with an endless screw y upon the axle of which is attached the wheel H. This latter by means of a chain belt is coupled with the wheel H keyed to the horizontal axis of the guide-wheel R.

A sheet of paper is tacked on the horizontal table S and on this the pencil T makes its mark. Now if the machine is drawn forward on a straight line the three wheels R, R' and R'', being of equal diameters, will develope equal tracks; the axles E and E' and the shaft O are put in motion; and the pencil will trace upon the paper a straight line which starting from the center will follow a radial line to the circumference of the table S. But, if we turn to the right, for example, with the machine the wheel on the right will revolve more slowly and that on the left faster, in contrary directions; the axle E' will turn quicker than the axle E, and will turn the wheel I on its axis to the left and move with it the double sector K; this will move the pinion P and as a consequence the plate S, and make the pencil describe an angle corresponding with that made by the vehicle. The pencil will describe an arc of a circle measuring this angle and then continue straight on a radial line.

The vertical measurements, or the leveling, is accomplished as follows:—Upon the machine is fixed a hollow, vertical cylinder V, (Fig. 2), upon which rolled a sheet of paper. The base of this cylinder carries a worm-wheel which engages with a worm on the shaft O: the drum V is this given a uniform rotative movement when the machine is in motion.

To the left of this cylinder, fixed upon the frame C, is a cast-iron box t, (Fig. 4). The interior of this box is a bored cylinder that can be hermetically closed by a bolted plate; in the center is fixed an axis about which turns a drum t in thin sheet iron. One part of this drum is occupied by a partition forming a tight case m; a vertical pencil-carrier moves perpendicularly to the axis of the drum. Two ribbons of steel n o, n' p, are wrapped about the drum and fixed to it and to the vertical rule, in such manner that any roation of the drum is transformed into a vertical movement of the rule.

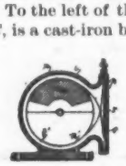


Fig. 4. Detail of Drum

This box t is filled with mercury; the case m forming a part of the drum t, constitutes a float with its center of gravity constantly in the vertical passing through the center of the cylinder. In use, when the vehicle, and with it the box t, leaves a horizontal plane to ascend an inclined plane, the movement of the mercury to accommodate itself to this change of level, causes the drum t to rotate, and by its connection with the steel ribbons give to the rule r a vertical motion, and thus trace on the revolving cylinder V, a profile of the road followed to a fixed scale.

This apparatus to work well, must be constructed with great exactness in all its moving parts.

PUBLICATIONS RECEIVED.

Annual Statistical Report of the American Iron and Steel Association, containing complete statistics of the American iron trade for 1886 and previous years, and a brief review of the present condition of the iron industry in foreign countries. Copies can be obtained by mailing $2 to JAMES M. SWANK, General Manager, 261 South Fourth street, Philadelphia.

This invaluable work of Mr. SWANK and the Iron and Steel Association is too well known to require extended notice here. We have elsewhere given a brief summary of its contents.

Boiler Making for Boiler Makers. A practical treatise on Work in the Shop, Showing the best methods of riveting, bracing and staying, punching, drilling, smithing, etc., and the most economical manner of obtaining the best quality of output at the least expense. By W. H. FORD, M. E., New York, 1887; John Wiley and Sons, Publishers. Size, 6x4 in.: pp. 233, illustrated.

The author of this book confines his teaching to the workshop, and touches very lightly upon the power, capacity and economy of boilers as subjects already well and fully treated. The workshop practice is gone into very fully, but in a plain, straightforward manner, and illustrations are profusely used wherever they can aid the text. The book is doubtless what it professes to be—a handy reference book for boiler-makers.

Mapa de la Republica de Honduras. By A. T. BYRNE, C. E., M. E., civil engineer in the employ of the Honduras Government. Published by G. W. & C. B. Colton, New York, 1887.

This is a new Spanish map of an interesting region, showing by definite symbols the various cities, towns villages, ranches, etc., telegraph stations and post-offices, highways and finished and projected railways. Mineral deposits are also indicated by circles of varying color for each.

Report of the Second Annual Meeting of the Illinois Society of Engineers and Surveyors, Jan. 26, 27, 28, 1887. Price 35 cts. Address A. N. TALBOT, Exec. Sec. Champaign, Ill.

This publication contains a number of interesting, and very useful papers, and is worth much more than the sum asked for it. These papers are of especial interest to those engaged in land surveying and draining enterprises.

Statistics and Water Rates.—National Meter Co., New York, 1887. While this book is issued in the interest of a manufacturing firm, there is more information in it relating to water meters, water rates and the consumption and waste of water than we ever saw elsewhere between two covers. We advise anyone interested in this important subject to obtain it, which can be done by sending to the above named Company at 252 Broadway, New York.

Iron and Steel Production.

The annual statistical report of the American Iron and Steel Association was presented to the members on April, 25. The trade for last year is fully reviewed, and while the opinion of its results is favorable, General Manager JAMES M. SWANK is not disposed to make predictions on account of such "unknown quantities" as the crops and the Inter-State Commerce bill. A summary of the statistics of 1886 follows:

"Production of pig iron, net tons, 6,365,328; production of spiegeleisen, included in pig iron, net tons, 47,982; production of bar, rod, bolt, hoop, skelp, and shaped iron, net tons, 1,580,337; production of plate and sheet iron, except nail plate, net tons, 420,007; production of iron and steel and combined iron and steel cut nails and spikes, kegs of 100 pounds, 8,160,973; production of steel nails only, kegs of 100 pounds, 2,968,989; production of all rolled iron, including iron nails and excluding rails, net tons, 2,259,943; production of Bessemer steel rails, net tons, 1,763,667; production of open hearth steel rails, net tons, 5,255; production of iron rails, net tons, 23,679; production of iron and steel street rails, included above, net tons, 48,009; production of Bessemer steel ingots, net tons, 2,541,493; production of open hearth steel ingots, net tons, 243,250; production of crucible steel ingots, net tons, 80,609; production of blister and patented steel, net tons, 2,651; production of all kinds of steel, net tons, 2,870,003; production of iron blooms, net tons, 41,909; value of imports of iron and steel, $41,630,779; value of exports of iron and steel, $14,865,067; imports of iron ore, gross tons, 1,039,433; production of anthracite coal, gross tons, 32,136,362; total domestic production of coal, gross tons, 106,780,033; miles of railroad completed in 1886, 8,648; total number of miles of railroad Dec. 31, 1886, 137,158; iron and steel ships built in the fiscal year 1886, 26; immigrants in the calendar year 1886, 392,887,

The Latimer Safety-Guard Patent.

The following is the "Specification forming part of Letters Patent No. 137,694, dated April 8, 1873; *application filed May* 4, 1871," for "a certain Safety-Guard for Railroad Trains," as patented by Mr. CHARLES LATIMER, who has since transferred the patent to Mr. W. J. MORDEN. We italicize those words which seem to have a special bearing on the scope of the patent:

Nature and Object of the Invention.

The invention relates to providing a bridge, curve, or other place on a railroad track where there is danger of the wheels of a truck running off the track, with a means of replacing the wheels upon the track, and at the same time preventing their moving so far from the track as to pass over the ends of the ties or sides of a bridge. The device consists of a lozenge or diamond-shaped platform *of somewhat greater height than the rails*, and placed between them at one or both ends, or in the center of a curve or bridge. The said platform is provided with guides *of even height therewith*, which are united at either end of the platform and *prolonged on the center of the track a desired distance*. About the center of the platform, between it and the rails, are placed bars of proper dimensions, of less height than the platform, grooved on the side toward the rails, and having an upward and outward transverse inclination at each end. Opposite these, outside of and corresponding in height with the rails, are placed the other bars, which have at each end an upward and transverse inward inclination.

Description of the Accompanying Drawing.

Fig. 1 is a plan view of a device embodying the elements of the invention. Fig. 2 is a perspective view of same, showing the inclination of the lifters. Fig. 3 is a vertical transverse section through the line *x x*. Fig. 4 is a similar view through the line *z z*. Fig. 5 is a side elevation with certain parts broken out.

General Description.

A in the accompanying drawing are the rails of a railway, between which, as shown, is constructed the platform *B*, of wood or any other suitable material, and of a lozenge or diamond shape—that is, tapering to a point at each end, on a line with the center of the track. The platform *is of somewhat greater height than the rails*, and is faced on its sides with the guides *C*, which are composed of *bars of metal or other suitable material firmly secured* in a vertical position *to the backing*, and are, or may be, inclined at their upper edges toward the platform, at each end whereof *they are united into the single guide rail or prolongation D of the same height as the platform B, and extending upon the central line of the track a proper distance*. The space between the guides *C* is *filled with a backing* of timber or other suitable material of even height with the guides, and *is intended to support the wheel or wheels* should the truck run off the rails at a point adjacent to the platform; and also to brace the guides one against the other, thus rendering the entire construction compact and capable of resisting lateral pressure. The center of the platform *B* forms on each side an obtuse angle, adjacent to which and between which and the rails, are placed the bars or lifters *E*, which are of less height than the platform *B*, widest at their ends, and correspondingly decreasing in width until they vanish, or nearly so, at the obtuse angles of the platform *B*. They are provided from end to end with a channel running parallel to the rail, and at each end have an upward and transverse inclination, the latter being toward the rail. The bars or lifters *F* are placed in contact with the rails outside of and directly opposite the lifters *E*, with which they correspond in length and height, having their upper surfaces flush with the rail, and their ends having an upward and transverse inclination, the latter being toward the rail. The guides *C* are formed with plain surfaces that, form being preferable to the ordinary T-rail, as being less liable to catch snow.

It is obvious that the device may be divided at its center, and one section placed at each end of the curve or bridge.

Operation.

The truck of a car running off the track *A* is guided by the contact of the wheels with the guide-rail *D* and and guides *C* until they reach the inclines at the end of the lifters *E* and *F*, up which they ride, being directed on each side toward the rails, the wheels outside the track running upon the top of the lifter *F*, while the flanges of the other wheels, being in contact with the guides *C* or lifter *E*, draw the opposite wheels constantly toward the track until the obtuse angle of the platform *B* is reached, when the flange of the opposite wheel is drawn over the rail and drops into the channel between the lifter *E* and the rail, while the other wheels pass at once upon their rail, thus retracking the car-truck.

Claims.

What I claim as my invention, and desire to secure by Letters Patent, is:

1. THE PLATFORM *B* provided with the guides *C*, *in combination with* the lifters *E* and *F*, substantially as shown and described.

2. THE GUIDE-RAIL *D*, for the uses and purposes substantially as shown and described.

3. The platform *B* provided with the guides *C*, in combination with the lifters *E* and *F* and guide-rail *D* substantially as shown and described.

C. LATIMER.

It will be observed that while the "lifters" or re-railing frogs, and their action, are described very elaborately, as if they were (as in fact they are) the heart of the invention *no claim is made on them*.

C. LATIMER.

Safety-Guards for Railroads.

No. 137,694. Patented April 8, 1873.

Fig 1.

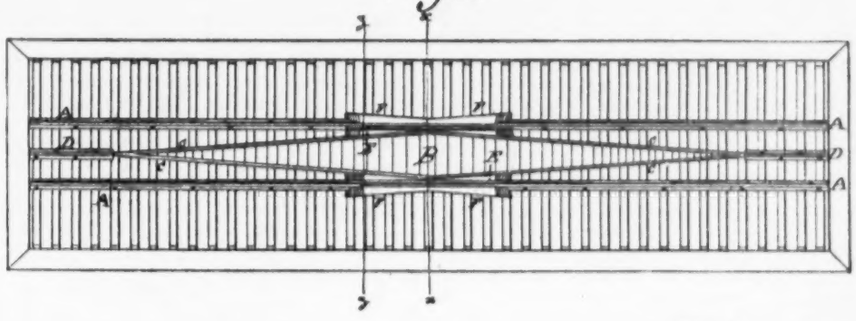


Fig 2.

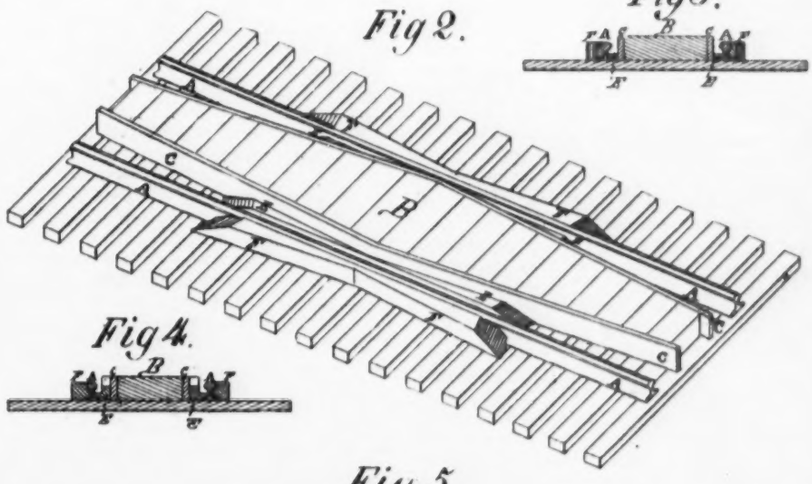
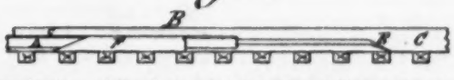


Fig 3.

Fig 4.

Fig 5.



Reproduction of the Latimer Safety-Guard Patent Drawing.

Stripped of the legal phraseology and verbosity the only claims are these:

1. The PLATFORM *B* "substantially as shown and described," which is one made of wood or other material, filled in to a solid level "of somewhat greater height than the rails," and "faced with *bars of metal* or other suitable material;" this peculiar wording being a necessity to have something *new* to claim on. If any one does not wish to use this solid platform, but only some guiding rails running to a point in the same way, there is nothing in the world to prevent him doing so, and this is really the better way of constructing the guard, and the one used now in all the Latimer guards that we know of.

2. The guide-rail *D* EXTENDING BEYOND the point of the guide rails proper *C. C.* This prolongation is almost purposeless, and is not used in any Latimer safety-guards that we know of. It simply brings the point of the guard a few feet nearer to the point of derailment, so as to make it, say, 780 ft. instead of 790 ft. off.

3. The combination OF SUCH A PLATFORM and SUCH AN EXTENDED GUARD-RAIL with the "lifters" or re-railing frogs. If anyone chooses to use those lifters and re-railing frogs with a different kind of platform, or no platform at all, there is nothing in the claims to prevent him. He can use guide-*rails* running to a point in the center of the track, with re-railing frogs in the crotch, as much as he likes, but he cannot use a platform such as described, or lay an extended single guard-rail in the center of the track, until April 8, 1890, when the patent will run out; ——neither do we believe that any one will want to, or ever has wanted to.

THE CYCLONE PULVERIZER.—A practical exhibition of the Cyclone Pulverizer was given on April 26, in the presence of A. J. SHAW, Manager, Standard Oil Co., SAMUEL WAGNER, of Philadelphia, and others. Various materials were fed to the machine and ground to powder. The test of reducing 25 lbs. of shingle nails to powder took about ten minutes. The machine consists of a cast-iron box containing two fan blowers, between which the material is fed by means of a revolving screw. The fans have each two two spoon faced blades of hardened steel and revolve in opposite directions at a velocity of from 2,000 to 3,000 revolutions per minute. The action of the machine is by creating such a current of air as will move the materials to be pulverized, causing them to be ground up by friction.

ENGINEERING NEWS

VOL. XVII. Saturday, May 7, 1887.

D. McN. STAUFFER. A. M. WELLINGTON. EDITORS.

GEO. H. FROST, - - - BUSINESS MANAGER.

Subscription. — UNITED STATES AND CANADA, $5.00 *per Year;* $2.50 *for Six Months;* $1.50 *for Three Months; Single Copies,* 12 *cents.* FOREIGN COUNTRIES, $6.56 *per Year, or* 3 *cents per number additional.*

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WE call the especial attention of our readers to a letter from Mr. CHAS. F. STOWELL in another column, and its accompanying note, from which it will appear that we unwittingly did a serious injustice to the *Railroad Gazette* in respect to their accident record, by inferring omission in a number of instances from the far less serious fault of irregularity in classification, and from the fact that all the omissions therewith, which were comparatively few, were bunched together in a few months. We are especially glad to be able to make this correction in behalf of a journal which has done such good work for the cause of science and sound practice as the *Railroad Gazette* has done and is doing, and in behalf of a record which, whatever imperfections it may have—which are largely unavoidable—has grown to be of the greatest value, as we endeavored to cordially recognize.

WE regret greatly to find that the response to Mr. DORSEY'S generous offer to be one of twenty to give $100 each to a fund for supplying the more urgent deficiencies of the library of the American Society of Civil Engineers has not been such as to give much hope that the offer will become available. Only a single member, Mr. ECKLEY B. COXE, has added another $100 to the previous subscriptions of Mr. DORSEY and this journal. What the causes are for this backwardness in coming forward it would be useless to surmise; but the motives which actuated one man at least —a prominent member and ex-officer of the Society—were thus expressed in a letter to us.

"I notice what the ENGINEERING NEWS is doing about an engineering library, and would approve of it if the Society of Civil Engineers was a fit custodian of a library, but that institution already has more books than it is willing to take proper care of."

Our correspondent does us too much honor in stating that we are "doing" anything whatever in the matter except to give what publicity we can to a very generous offer of one of our subscribers. We are somewhat surprised that the offer has not been more generally taken up, but still believe that the membership generally would feel a real interest in making the library a worthy one, if a movement to that effect were once started. For example $1 per year added to the dues of each non-resident member, and $2 per year to the dues of each resident member would give a fund of over $1,000 per year to be expended in books. This would buy all the more important technical publications of the world each year which are not given to or otherwise secured by the Society. It may well be that all would be willing to give $1 per year to the library, when there would not even be twenty who are willing to give $100. The number of men who are willing to give $100 each, is clearly much smaller than Mr. DORSEY supposed, or than we did.

WORK is progressing well on the new bridge across the Harlem river; the masonry on the two shore piers is about up to the top of the skew-back course; several courses are laid on the center pier proper and the piers for the shore arches under the approach are at the springing-line. The masonry as far as laid is very massive and as a specimen of cut-stone work is worthy of special commendation. It is so very unlike the original plans approved by the Commission that we must withdraw our charge of "cheap work" and lack of good taste in the design; instead of blank walls of rubble masonry carrying the approach, the present design includes two 60-ft. span arches on either side of the main river bridge; the rubble work is replaced by very handsome coursed granite masonry on the ends of piers and quite as handsome irregular range squared work on the sides of the piers. The cut courses at the skew-backs are simply magnificient pieces of stone and stone-cutting and the character of the concrete filling and masonry generally is such as to reflect much credit upon engineers and contractor.

If we made any criticism at all at this time it would be that too much money is being expended in the skewbacks for the main arches. There will be six of the metal arches and where they abut upon the piers a space of about 6 ft. wide by 14 ft. on the angle is provided; at this point a recess about 2 ft. deep is left in the masonry to be filled by two enormous stones laid normal to the thrust of the arch. This method is doubtless theoretically correct but the question arises whether the result is worth the very great additional expense, as compared with laying the sloping skewback with horizontal courses throughout in the same manner as they are now laid *between* the arches. The metallic truss abuts against a heavy casting, weighing we believe about 15 tons; this casting and the flat stone behind it are intended to distribute the load and carry it to the mass in the pier proper. But in the present plan this load is really transferred to heavy horizontal courses back of the flat stone and then to the concrete filling. The whole strength of the structure depends after all upon the character of the *backing* of the skew-backs; if this were beyond reproach, as it evidently is, we would contend that the expensive recess and the stones laid in it normal to the arch-thrust were hardly necessary, and the heavy base plate might just as safely have been laid on the battered faces of the horizontal courses. If the backing were not sufficiently massive and firm to resist the thrust, the single course of stone might as well be absent for all the good its presence would do. But yet, the additional stone does no harm, and may tend to stability.

A SUCCESSFUL test was made last week at Pittsburg of a device invented by Mr. S. H. HARRINGTON, of Columbus, who is connected with the motive department of the Pittsburg, Cincinnati & St. Louis road, for putting out fires in car stoves in case of derailment. The device acts on the principle of a Babcock extinguisher, and is connected with the automatic brake so that when a car or train is derailed it is put in action, causing carbonic acid gas to be discharged into the stove and "smother the fire at once," as the newspapers put it. A rail was loosened from the track, and a passenger car run off, and the extinguisher put out both fires.

If cars could only be relied on to run off the track in this quiet and orderly fashion, the device, we have no doubt, would be a thoroughly satisfactory one. Unfortunately, the need for putting out fires is more apt to come "in an instant, in the twinkling of an eye," and as a result of collisions and falls from bridges, as well as from derailments. A very common result, moreover, is that car, stove, extinguisher, pipe-connections and all, are at once involved in a common ruin, leaving the heat in the coals intact. Again, while carbonic acid gas will at once extinguish combustion, there is no magic about it to destroy heat, which can only be dissipated by the slow process of radiation or convection. If there is TIME for this heat to be carried off while the stove is intact, all right, but then there is no need for extinguishing the fire at all. If there is not time, and the coals are scattered before they are cool, a red-hot coal is just as dangerous, whether it was lately burning or not. The more the question of car stove heating is looked into, the more clearly it appears that it is essentially and incurably dangerous, and unnecessarily so, since there is no theoretical or practical difficulty in heating from the locomotive.

A CORRESPONDENT sends us a letter stating that "on the new short cut of the New York, New Haven & Hartford Railroad I noticed a a very careless piece of construction; the roadbed held up on a steep side-hill merely by *a pile of old ties,* which it seems worth while to call attention to, as a very careless and dangerous way of constructing a roadbed, even in new work."

The locality, and even the road on which the defect occurs, are too vaguely specified to make it worth while to publish the letter in full, but it is certainly a most dangerous method of construction, *especially when the ties are afterwards filled over by earth or rock.* Only last year there was a very bad accident on the Hoosac tunnel line, that at West Deerfield, Mass., on April 7, which was chargeable to this cause alone. The entire train except the engine was precipitated down a 1 to 1 slope 100 ft. high, and out of 48 people on the train, 10 were killed, 35 injured, and only 3 escaped uninjured, making it the most serious accident due to defects of track or structures which had occurred in the United States in the ten years since the Ashtabula disaster. Since then the Woodstock and Bussey bridge disasters have both outdone it, but perhaps there is no kind of probable negligence in construction which is more sure to cause a serious accident in time, than just what our correspondent specifies. The difficulty is, that the ties permanently prevent all consolidation of the new bank with the old, while the very existence of the ties under the bank is sooner or later forgotten.

THE spring meeting of the American Society of Mechanical Engineers, (the fifteenth since the formation of the society), will be held at Washington, D. C., from Tuesday, May 31, to Friday, June 3.

The professional sessions will be held in Willard's Hall, adjoining Willard's Hotel, where the rate will be $3.00 per day. A special early lunch which will be provided for attendants at the convention. To facilitate visits to the public buildings, the sessions are to be only in the afternoon, after the first day.

The sessions will extend over four days. On the second day a reception has been tendered to the society by Hon. JOSIAH DENT, at his

historic residence. On the third day a trip will be made to Mt. Vernon. Accompanying the circular is a summary of very sensible rules for insuring full discussions of papers. If they could only be lived up to, the effect would be ideally good, but it is one thing to make rules and another to enforce them.

Contractors, Engineers and Extra Work.

In our last issue we noted the controversy then, and now for that matter, going on between the New Croton Aqueduct Commission and its contractors regarding the ever-disputed question of allowance for extra tunnel excavation. Since the publication of that note we understand that the Commission and its legal advisor have so far made concessions as to adopt certain recommendations of the Chief Engineer of the Aqueduct touching this matter, and to do, in part at least, what should be wholly done—leave the adjustment of this difficult dispute in the hands of the only competent judge.

No contract or set of specifications for a great public work were probably ever drawn up that did not in the end furnish grounds for a dispute between master and workmen. This is especially the case in tunnel-work, for unfortunately for engineers and contractors tunnels are not driven through chalk or cheese, but through rock, generally, that has a trick of arranging itself in all manner of slips and faults and unexpected and awkward angles of stratification, and with good, indifferent and very bad working qualities. For these very reasons it is simply impossible to arrange a set of specifications that will cover every possibility of an unexplored, underground working. And the tendency of nearly all specifications is to compel the contractor "to bet against the Almighty," as an old railroad-builder once put it, by requiring him to take all the chances arising from "loose and shaky rock, or from falls or cave-ins, or from unexpected obstacles."

The corporation says, that by so doing we warn the contractor beforehand, and expect him to put a price upon his work that will discount all these chances. It further says, all through its specifications for work to be done. The contractor is a "bad man;" we can make no concessions; if we "give him an inch he will take an ell:" if we make any allowance, for example, for tunnel excavation beyond a normal line, he will tumble down rock unnecessarily, either in his haste to make progress or by careless or vicious methods of working; we will fix this thing therefore by placing all the responsibility upon the contractor and make him take the chances which we can neither foretell nor provide against.

Now while this is a very easy method of disposing of the difficulty, from the corporation standpoint, it is really taking a somewhat cowardly advantage of human nature as exemplified in the average contractor. The corporation knows full well that the contractor rarely studies the specifications carefully, and further that he will *not* discount the chances when it is a question of competition with rival contractors; but in his burning desire to get the work anyhow, and with his abiding faith in getting through somehow, he will bid it down to a figure which will not cover the range of possibilities. It may be said that such a man deserves punishment, and in fact very many contractors do suffer by the loss of their last dollar in working under this "chance" clause; but their fate is often an unjust one. The corporation should expect to pay the full cost of the execution of its work, with a reasonable profit added for the contractor's time, experience and general services, as long as this work is done in a proper and workmanlike manner.

And just here comes in the difficult problem of drawing the line between "extra" work arising from conditions over which neither master nor man have control, and unnecessary work due to carelessness, lack of experience or vicious intent. Specifications, no matter how elaborate, will not meet this difficulty; they should be carefully drawn up with the idea of dealing strictly, but justly, with all parties concerned; but like the law, all specifications require an interpreter.

And here comes in the engineer. It is the first duty of a corporation to select as its engineer not only a fully competent man in all that pertains to his profession, but also a man who is experienced in dealing with men and is honest and just; the next thing is to provide this engineer with all the machinery necessary to intelligently perform his duty, and lastly to leave him alone, untrammelled by the private views, prejudices or meddling of commissions, directors or legal advisers that, as a rule, know simply nothing of the matters upon which they too often attempt to force judgment.

Annual Convention of 1887, American Society of Civil Engineers.

Messrs. WM. G. HAMILTON, STEVENSON TOWLE and JOHN BOGART, the Committee on Convention for 1887, announce officially that this convention will be held at the Hotel Kaaterskill, New York, beginning about Saturday, July 2. This hotel is one of the largest in the United States, overlooks many miles of the course of the Hudson river and its magnificent scenery, and can be reached either directly by rail from Rondout and Kingston, or by rail from Catskill to the foot of the mountain and thence by carriage to the hotel.

The programme contemplates the gathering of members in New York and a departure by steamboat up the Hudson on the day previous to the opening of the convention. A stop will probably be made at West Point and at the Poughkeepsie bridge now in progress of erection. Other excursions will probably be made to the cement rock mines and the cement works of the Rondout Valley. The hotel rate is $3 per day, the hotel being ordinarily a $5 house.

The following are among the papers open for discussion at the convention:

"Formulas for the Weights of Bridges:" A. J. DUBOIS.
"Vibration of Bridges:" S. W. ROBINSON.
"On Specifications for Strength of Bridges: J. A. L. WADDELL.
"On the Calculations of the Strain in Bridges for the Actual Loads:" G. F. SWAIN.
"The Water Supply, Drainage and Sewerage of the Lawrenceville School:" F. S. ODELL.
"Determination of the Size of Sewers:" R. E. MCMATH.
"Anchor Ice:" JAMES B. FRANCIS.
"steel: Its Properties; its use in Structures and in Heavy Guns:" WILLIAM METCALF.
"Some Constants of Structural Steel:" P. C. RICKETTS.
"Irrigation:" EDWARD BATES DORSEY.
"The Brick Industry near New York." CALVIN TOMKINS.

It is expected that the following subjects, most of them suggested by some of the papers published or received during the past year, will be particularly discussed, and communications upon these subjects are especially invited by the Committee, viz:

"The Inspection and Maintenance of Railway Structures:" "The Disposal of Sewage:" "Recent Practice in Cable Railway Propulsion."

WE present elsewhere a part of certain facts in regard to the Latimer re-railing guard rail, which cannot but be regarded as of general interest, the rest of which we must postpone till next week.

Car-Couplers and Brake Tests.

The car-coupler contest at Burlington, Ia., last week, on the Chicago, Burlington & Quincy Railroad, was not wholly decisive, perhaps, but on the important question of relative shock to trains from various couplings they were so nearly so that there is no very grave room for doubt left, especially as the brake tests last year gave still more conclusive evidence on this point. When there was loose slack between the cars the shocks were of the most extreme violence, worse than in an ordinary collision, while when this loose slack was taken up by iron blocks, to correspond to the conditions with close couplers, the shocks were very moderate indeed. These last tests show substantially the same results, the following giving the comparative *total movements in four successive stops* of the impact gauge—which latter is a mere iron disc sliding in a planed white-pine trough:

Total Movements of Impact Gauge in Four Successive Stops in each Trip, with Four Different Kinds of Couplings.

[Train of 25 box-cars, empty except as noted.]

	Link & Pin		Perry.	Ames.	Janney.
	ins.	ins.	ins.	ins.	ins.
Total slack.....	78⅞	8	51	43⅝	12.5
Slack per car.....	3.2	0.3	2.1	1.7	0.5
Impact gauge movement,.....					
First trip.....	54½		41½	30½	18
Second trip.....	—	31¼	42¾	27½	23⅝
Third trip.....	—	—	(ld.) 25	—	10⅝
Fourth trip.....	—	—	—	—	(ld.) 18½
Average per trip.	54½	31¼	36⅛	29	12½

[A stop becomes unduly violent with a movement of the impact gauge of about 8 in., or 32 in. per trip. With 50 car trains the impacts in all the above tests would probably have been from four to six times as severe.]

There are certain ambiguities in this table, as there are apt to be in tests, but the main result is clear. The elimination of slack is a very great additional safe guard in the way of shocks, and from these shocks come a very large proportion of the broken draw-bars and draw-gear, broken sills, breaking in two of trains, injury to live stock in transit, etc., etc. The most curious anomaly in the table is the very small gain from reducing the slack in the common link and pin coupling to 8 in. instead of nearly 80 in. (which was done by inserting iron wedges) as shown in the first two columns of the table. This is explained in part by the fact that the cars were old and the springs poor, but it can not explain it altogether. Otherwise, the results are tolerably consistent, and we believe essentially correct.

The brake tests at Burlington will begin on Monday of the coming week, May 9, and there will probably be a good many surprises brought out. Both the WESTINGHOUSE and EAMES (automatic vacuum) brakes will, it is understood, be applied electrically, thus saving the loss of time in getting the brakes in action which has heretofore almost doubled the length of the quickest stop. The American Brake Company will bring out an entirely new air-brake, of the automatic type, but quite different in its details from the WESTINGHOUSE, we are informed, and claimed to be much cheaper. Its efficiency remains to be proven on a large scale, but shop tests are said to have been very satisfactory. The WIDDIFIELD & BUTTEN is expected to appear with its former buffer brake, with improvements, and even the ROTE buffer brake, which completely failed to do good braking last year, is expected to put in an appearance again. The American will certainly not be on hand with its new train when the tests open, and the entrance of the two latter into the tests is not absolutely assured, we judge.

Of new brakes which have not heretofore been tested there will be the HANSCOM, a peculiar "straight-air automatic," which uses a double line of hose, the CARPENTER, a modification of the WESTINGHOUSE, which is now much used in Germany, and which we understand is claimed to be an infringement on the latter, the CARD electric brakes, and the BOYDEN (if it finally enters) as to the character of which we are not informed.

Thus there will be four brakes in all which use electricity in some way, the WESTINGHOUSE, EAMES, CARPENTER and CARD, and two new automatic air brakes, the AMERICAN and HANSCOM. The simpler types of buffer brakes will be a decidedly less prominent feature than last year. It is probable that we owe this extraordinarily rapid drift of events toward the most perfect type possible almost wholly to last year's tests, which were of great value to the competitors as well as to the general public for indicating the good and bad points of each brake. One thing is certain, that those who strive toward the most perfect type possible are by far the most likely to meet with the reward of acceptance.

We look forward with confidence to seeing the quickest stops, by far on record, for trains in service, made in these tests.

CORRESPONDENCE.

Oil and Gas Well Boring.

TARRYTOWN, N. Y., April 27, 1887.

EDITOR ENGINEERING NEWS:

The correspondent you refer to, as asking for a book on oil and gas well drilling, can find what he is after in Mr. J. F. CARLL's report I. I. I. of the Second Geological Survey of Pennsylvania, which can be had at cost of publication by communicating with the office of the Survey, 907 Walnut street, Philadelphia. An atlas of plates accompanies the report, which should also be obtained.

Yours truly, H. M. CHANCE.

The Temporary Bussey Bridge.

SOUTH BRAINTREE, MASS., April 26, 1887.

EDITOR ENGINEERING NEWS:

A party of gentlemen from Dedham, myself one of the number, examined the new bridge built at Roslindale by the Boston & Providence Railroad, and although having no practical knowledge of bridges, the impression with all was not very favorable. As we pass over it every day, we naturally feel anxious, and should like your views upon the subject. The company seem to rely to a great extent upon wedges under the uprights, and to an inexperienced eye they do not look safe. If you will kindly mail to me a dozen copies of any report you have, or will make, you will oblige. Yours truly,

HENRY L. WILLIAMS.

[We have had another inquiry to this same effect, which added the fact that the temporary structure was placed directly on the frozen ground, with little or no excavation. It is natural, after a great disaster, that every thing connected with or in the vicinity of its scene should be regarded with suspicion, but in this case we see no reasons for serious apprehension. A wooden trestle, *when new*, is a pretty safe structure, if plenty of timber is used in it, which we assume to have been the case. It is not, of course, good practice to place such a structure on frozen ground and to rely on wedging it up as it settled, but wedging, properly done, is an admissible and safe resort, and until the frost comes out of the ground the structure is not made in anyway unsafe thereby, provided only that it is carefully watched. We presume the expectation was to begin work immediately on the permanent structure, when the frost comes out of the ground, and in that case the course taken was the natural one.—ED. ENG. NEWS.]

Measuring Rock in Trenches.

BATH, ME., April 20, 1887.

EDITOR ENGINEERING NEWS:

Having taken your paper for many years, I take the liberty of asking you to decide a question which is in discussion here, which is this: What is the proper way to measure ledge found in digging trenches for water pipes? A says that the only correct way is, to measure it before being blasted. B says that he never heard of rock being measured that way; that the only safe and correct way is to measure the depth of the trench, and the width and length where the rock shows on the sides of the trench after being taken out. If you will please decide this question you will oblige us very much.

Yours truly, H. J. C.

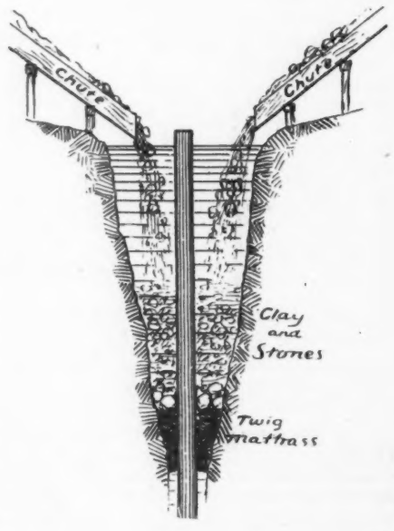
[In a railroad cut, or in very wide trenches, with rock of irregular top surface, or showing a "backbone", the safest method is to strip and measure before excavation. In a comparatively narrow trench with rock as usually found, it is usual and safe to excavate, and then measure from the rock showing on sides and bottom. The ascertaining of the volume of a rock cut, where earth is also present, is a matter of estimate only, based upon experience and sound judgment, and the engineer must decide for himself upon the method to be followed as the conditions existing may direct. In any case his measurement is only an estimate more or less exact, in accordance with the judgment and care used in obtaining data.—ED. ENG. NEWS.]

The Iowa Geyser.

CLEVELAND, O., April 21, 1887.

EDITOR ENGINEERING NEWS:

In your last number you mention that the Belle Plain, Ia., geyser was still uncontrolled. You say there is a 16-in. wrought-iron pipe in the hole, but that stone, gravel, etc., put into the hole around the pipe disappear, proving that there is an underground stream. If there is a space around the stand pipe, which I judge there is, I think that wooden mattresses of twigs made to fit around the stand pipe and fill up the space between pipe and earth walls—and of sufficient thickness to fill the well at bottom above the stream, or up to solid walls—would prevent the disappearance of material



cast in. Of course, with the great upward pressure of water, it would require a great and sudden weight applied to force these mattresses down. To do this I would build two chutes, one on each side of the well, at an angle so steep that material, stone and clay, would, when released, slide down quickly on the mattresses, and by this constantly increasing weight might be forced down. I would put up chutes to hold sufficient material, and use stone and good slags, and let it down like an avalanche. It might not succeed, but seems the most promising plan.

R. GURLEY.

[We understand that the geyser has been successfully choked for the moment once or twice, but the trouble is, as soon as the flow is restricted to the pipe, sand or other substances lodge in the lower bell, so as to choke it likewise, and the whole thing then breaks loose again.—ED. ENG. NEWS.]

Target Error in Leveling.

CHAMPAIGN, Ills., April 16, 1887.

EDITOR ENGINEERING NEWS.

In connection with the experiment described by Mr. TRAUTWINE on page 239 of your issue of April 9, I desire to call the attention of your readers to the error in leveling due to the form of target. In the experiment referred to the thickness of the cross-hair subtends an angle of about 3 in. and hence owing to the form of target, the center line of the latter could be moved through a vertical angle of about 6 in. without the change being perceptible through the instrument, therefore the average error from this cause will be about 1½ in. If an × or a diamond had been used for a target the error would have been considerably smaller. In my class instruction I have a problem involving nearly the conditions of Mr. TRAUTWINE'S experiment except that the distance is 1800 instead of 600 ft. and that a diamond is used for a target. The average error, for a dozen students, of placing the hair over the center line of the target is 0.5″. The distance is three times greater, and the error is three times smaller than in Mr. TRAUTWINE'S experiment. I think the whole difference is due to the form of target. I cannot see that there is any other element that materially affects the problem. There are a few points in which Mr. TRAUTWINE'S condition are more favorable for accuracy; his instrument magnified thirty times, the other twenty-two; his was bedded to the pier, the other simply stood upon it; he certainly had the finest hairs. This evidence shows the inferiority of the ordinary form of level target, as already discussed on page 306 of Vol. 16. of the NEWS.

I beg to object to another of Mr. TRAUTWINE'S conclusions. He "doubts whether it would be possible (*sic*) with the average instrument mounted upon a tripod, to adjust the telescope with any certainty to a change of even *three*-tenths of an inch (0.025 ft.) in the height of the target 650 ft. away." In my class work, I have a problem which requires the student to determine the error of setting a level target. The two instruments used have bubbles of 75 and 85 ft. radius, and magnifying powers of 19 and 16 respectively; the tripods are of poor design and not in good order. The students select favorable atmospheric conditions. The distances are usually about 100 and 300 ft. Under these conditions, the range for ten observations is seldom over 10 thousandths of a foot, and the average error of a student is usually under 3 thousandths. Curiously we find but little difference in the error for different distances. Yours truly, I. O. BAKER.

The Area of Equilibrium Curves.

DEFIANCE, OHIO, April 12, 1887.

EDITOR ENGINEERING NEWS:

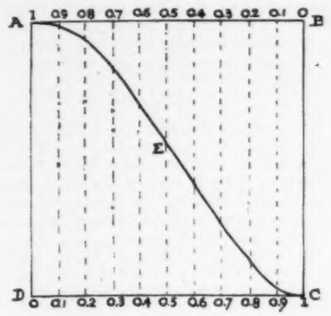
Prof. GREENE'S method of calculating strains on continuous girders by the moments of moment-areas with reference to the supports is beyond doubt the most rigorously exact and convenient of all. The only difficulty in the application of it lies in the time required to find the area of the equilibrium curve for a partial load and particularly the distance of its center of gravity from the supports. I offer a very short method of doing this when the load is uniformly distributed and which may be applied to loads at panel points after making certain corrections which are also exact.

The maximum strains (principally shearing forces) are to be determined when one segment of the span is completely loaded and the other wholly unloaded. This simplifies the problem considerably.

Also when this segment is completely loaded but the load is concentrated at panel points, then the angles of the equilibrium polygon for this partial load will lie in a parabola which will nearly coincide with the parabolic curve for the load uniformly distributed, but ending at half a panel length from the last loaded joint, especially when the number of panels is great. The areas and their moments that are wanted are those of the equilibrium curves for the span as a simple girder.

The method is shown in the figure. Let $A\ B = A\ D$ = unity; let w = load per lineal unit of the span; let l = length of span; let $v\,l$ = unloaded segment of span v, to be unassumed horizontally as shown; let H = closing line of force polygon. Notice that v is positive to the right along $D\ C$ and to the left along $A\ B$.

Now to find the moment of the moment-area with reference to the unloaded end, find the value of v and measure the ordinate corresponding to it between



DC and the curve. This is the coefficient which when multiplied by $\frac{w\,l^4}{24\,H}$ will give the moment required.

To find the moment with reference to the loaded end measure the ordinate between $A\,B$ and the curve which in like manner is to be taken as a coefficient of $\frac{w\,l^4}{24\,H}$.

The sums of these ordinates give a coefficient which when multiplied by $\frac{w\,l^3}{12\,H}$ give the area of the equilibrium curve.

These ordinates will not lie in the same vertical unless $v = \frac{1}{2}$.

With D as an origin v positive to the right and y positive upwards the equation of this curve is $y = (1-v^2)^2$.

I can only make a suggestion as to the demonstration of this but if the reader will examine the expressions $\Sigma P(k-k^3)$ and $\Sigma P(2k-3k^2+k^3)$ which appear in works on the continuous girder in which P is the weight and k the ratio of the distances of its point of application from the left support to the span, and will put $\Sigma P = w\,l\,dk$ and integrate between O and $1-v$ he will perceive the truth of it.

Correction curves for exact work are simple parabolas in which the number of panels enters as a constant. Where the number of panels are great they are almost indistinguishable from the lines $A\,B$ and $C\,D$, and in most cases are quite unnecessary.

Yours respectfully, C. H. LINDENBERGER.

The Railroad Gazette Accident Record.

State of New York:
Board of Railroad Commissioners,
ALBANY, N. Y., May 3, 1887.

EDITOR ENGINEERING NEWS:

In your editorial on "The Causes of Bridge Failures," on p. 287 of ENGINEERING NEWS, which I have just read, you have unjustly questioned the accuracy of the *Railroad Gazette's* statistics. It should be remembered that my table is one of "Bridge Failures," and the *Gazette's* one of "Train Accidents," and that the classification of the latter is made with reference to the causes of such accidents. Consequently all those "Bridge Failures" which appear in my list as being due to shocks from derailed cars, collisions on bridge, running over live stock, etc., you should find in a table of "Train Accidents," classified under their appropriate heads as derailments from such causes.

I have found the *Gazette's* tables to be generally reliable, and knowing by experience how difficult it often is to get full particulars of an accident, I am not surprised that the tables contain some errors, but that they are in the main so full and correct.

A careful search of these tables will show that every accident in my list is mentioned except the one at Kansas City on May 11, when a bridge was reported to have been wrecked by a cyclone. This was very properly omitted as it was not a train accident at all.

It may be pertinent in this connection to call attention to your editorial advice to the New York Railroad Commission on p. 204, current volume of the NEWS, first column. Yours truly,

CHAS. F. STOWELL.

[When Mr. STOWELL's list was received, we first investigated personally the facts as to bridge failure 19 (New York, Susquehanna & Western) as to which he expressed doubt. We found it to be a clear case of knock-down from derailment, and so reported in the "Broken Bridge" column of the accident record referred to. On checking off the other accidents on the list included in the same column, we found them to be only 11 out of 21, but that the reported causes for these "failures included all the following:

Fire—Weakness—Derailment—Washouts—Bad Loading Cars.

The reported causes for the ten bridge failures NOT in this column were:

Fire—Weakness—Derailment—Cattle—Collision—Cyclone.

We then, by an unlucky chance, started in with March, April and May to see if by chance the missing bridge failures were reported under other classifications than "Broken Bridge." In these three months all the omissions from the "Broken Bridge" column but one which we did not chance to begin with (the first on the list) *are omitted completely, viz.*, Nos. 5 (March 15), 8 (April 30) and 9 (May 11). Our correspondent is not correct in stating that these accidents can be found in the record, so far as a dilligent search by two members of our staff through the months of February to June inclusive for anything resembling them can determine.

Following on to July, there was only one (No. 13) missing from the "Broken Bridge" column, and that was reported among the derailments, but *it was not stated nor implied that any injury happened to the bridge*, but rather the contrary. In August again, all the bridge failures were reported as such.

With this sample of 5 months out of the 11 covered by the record, taken in connection with the variety of causes for the "Broken Bridges" which were reported as such, we rested content, unfortunately. The fact that the many collisions from misplaced switches are classified under the more important *result* "collision," instead of the provoking cause "misplaced switch," helped toward the inference that the same was the case with bridges.

While claiming on our own behalf that the circumstances were such as to have deceived the very elect, we readily admit on behalf of our contemporary that we did them a real justice, although not so great a one as our correspondent claims. The facts in brief are these: Out of 21 bridge failures, 17 instead of 11 are in the *Railroad Gazette* record; 1 was a cyclone bridge failure, and so not a train accident, 1 was reported as a derailment, but not as a bridge accident, and 2 bridges which fell under a train (5 and 8) were omitted altogether. All these failures were bunched in 5 months, and hence these tears, which we freely shed.—ED. ENG. NEWS.]

AN incandescent burner lately exhibited in London will prove gas a rival to the electric light, if it is all that is described. It consists of a so-called "mantle" of muslin, which has been impregnated with certain incombustible oxides produced from the rare metals zircenium and lanthanum. The cap or mantle is supported by a platinum wire in the flame of a Bunsen burner, with the result that the delicate incombustible network is brought to a white heat. The flame gives out intensely white light, which is perfectly steady and of high value; for a light of twenty candles is obtained from burning only two and a half feet of gas per hour.

Statistics of New Water-Works Construction.

(*Specially Communicated.*)

Uxbridge, Ont. Canada. The work done last year consisted in putting in half a mile of pipe and 4 hydrants at a cost of $1,100. WM. MCGUIRE is Superintendent.

Chelsea, Mass.—The high service works were commenced in September 1886, and are to be completed this year. The works are owned by the City and under the control of a Water Board. The population in 1887 is about 25,000. The contractors for engine house are Kilby & Coyne; for pumping machinery, the George F. Blake Manufacturing Co., New York; for pipe and specials, M. J. Drummond, New York; and for trenching, pipe laying and the reservoir, Trumbull & Cheney. H. W. FORBES is Chief Engineer.

Asbury Park, N. J. No returns have yet been made as the first year ends June 31, 1887. There are 8.5 miles of pipe, 185 taps, 36 meters, and 42 hydrants The mains are of cast-iron, and the service pipes lead and galvanized iron. The ordinary and fire pressure is 60 pounds. The works cost $60,000 and there is a debt of $60,000 at 5 per cent. interest. The daily consumption in summer is 400,000 galls., and in winter 40,000 galls., (the difference is due to the large summer population. many of the hotels and cottages using the artesian water being closed during the winter). GEORGE H. COFFIN is Superintendent. The works are controlled by the Water Commissioners.

TECHNICAL NOTES.

SALTERY's method of combining molasses with small coal to form briquettes is, according to the *Colliery Guardian*, fast coming into favor, not only in Germany, but in Belgium and in France. As a cementing material molasses is, in these countries, not only abundant and cheap, but comparatively free from mineral substances, so that but little ash is introduced into the fuel. The proportion of ash is about 10 per cent. As only from 1 to 1½ per cent. of the cementing material is needed, the ash therewith added will not exceed 1¼ per cent.

MORRIS P. JANNEY, of the Glendon Iron Co., of Easton, Pa., confirms a statement made in *Engineering*, some weeks ago, by saying that certain grades of molten iron are transparent. He has noted at different times for years that such iron when flowing over the dam in the "runner" was sufficiently transparent to permit the sand to be seen through it; this sand had a yellowish tint.

The *papier mâché* of commerce used in making the multitude of articles sold as "articles de Paris," has for its base a grayish-blue, unsized paper made entirely of cotton. Sheets of this paper are pasted one upon another with dextrine and starch until the desired thickness is obtained; the assembled sheets are then submitted to powerful hydraulic pressure and while yet damp are again pressed by moulds into the requisite shapes. When dry, the product has the hardness of the toughest wood, and can be sawed, filed, bored, etc.

IN 1751-60 four or five of the local surveyors of the Province of Pennsylvania undertook to adjust the boundary between the "three lower counties," now the State of Delaware, and Pennsylvania and Maryland. The circular portion of this line was drawn from the spire of the New Castle court-house, with a radius of 12 miles, and the eastern boundary of Maryland was to be a tangent to this circle. As attesting to the accuracy of these old-time surveyors, MASON and DIXON testified that their line, run in 1764, would not pass "one inch to westward or eastward" of the tangent set by the former surveyors. And Col. JAMES D. GRAHAM, of the U. S. Topographical Engineers, who triangulated in 1849 to test the radial line of the New Castle arc, found that his triangulation made the length of this radius only 2 ft. 4 ins. shorter than the 12 miles measured by the old surveyors. Considering the date and the instruments available then, this shows very careful work.

THE virtue of lime-wash as a protection against fire is emphasized by the *American Analyst*. In

France, it is common to thickly coat with whitewash the beams, joists, and the underside of floorings. While this precaution will not prevent the spread of a fire once under great headway, it is a guard against the prime ignition that often leads to dire results.

ACCORDING to the *Bautechniker*, Japan has now in operation 227 miles of Government and 120 miles of private railways; a total of 347 miles; 68 miles of Government and 42 miles of private lines are under construction; 246 miles have been surveyed, and 436 miles more simply projected.

THE Sonnblick Observatory, in the province of Salzburg, Austria, is the highest in Europe, being 10,177 ft. above the sea. Observations taken at this elevated point show a mean temperature in October of 25.9° Fah.; November 15.3° and in December, 8.1°. It is noted that the change of temperature with height, in the strata between 5,900 ft. and the summit, is almost independent of weather conditions, being about 1.3° Fah. for each 100 m., or 328 ft. and almost constant during the month. From 1,300 ft to 5,900 ft. the change varies from 0° to 1.1° Fah.

THE architects of Paris use a "metallic cement" in the repairs of the Louvre, Pont-Neuf, etc. It is made of a liquid and a powder as follows, says the *Bulletin Ceramique*:—The powder is made with 2 parts by weight of oxide of zinc, 2 parts of hard lime-stone, crushed, and 1 part of pounded sandstone; all of these ingredients are intimately mixed and ground, and some common yellow ochre is added as a coloring matter. The liquid is a saturated solution of zinc in the chlorhydric acid of commerce, with one part by weight of chlorhydrate of ammoniac, equal to ½ of the zinc dissolved. This liquid is mixed with ⅛ of its volume of water. To use it, temper one kilogram (2.2 lbs.) of the powder with 30 decilitres (5.28 pints) of the liquid. When the thickness of the repair coating exceeds 1½ in., the necessary depth is secured by building up with fragments of good stone. This metallic cement hardens very quickly, and after 48 hours will resist a tensile strain of 142 lbs. per sq. in.; after 4 months it will stand 683 lbs. per sq. in. After half-a-year it will resist nearly 4,000 lbs. per sq. in. in a crushing test.

AUGUSTE HERBERT suggests as a substitute for a bath of sulphate of copper for the preservation of canvas, awnings and cordage, the use of a cupro-ammoniacal liquid. While the sulphate of copper has not given marvelous results, it certainly does protect the vegetable fibre for some time. But the liquid suggested modifies the state of these fibres and renders them impermeable and undecaying without decreasing their strength. Paper can be treated with similar results.

PERSONAL.

J. H. OLDS is Chief Engineer of the Perry County R. R., Pennsylvania.

GEORGE RICE, of Philadelphia, has been appointed Chief Engineer of the Pittsburg Traction Co

C. E. BRIGGS has been appointed Chief Engineer of the Ohio & Mississippi R. R.

F. H. HARRIS is Chief Engineer and Superintendent of the Rome and Carrollton R. R., with headquarters at Rome, Ga.

ALFRED R. WOLFF, M. E., heretofore of 85 Astor House, has moved his office to the Potter Building, 38 Park Row, New York.

THE NEUCHATEL ASPHALTE CO. has changed its address to 265 Broadway, New York City. HENRY R. BRADBURY, Manager.

FRANK D. MOORE, formerly Chief Assistant to the late C. SHALER SMITH, has been appointed Chief Engineer of the new bridge at Omaha, Neb.

S. T. SMITH, General Superintendent of the Union Pacific R. R., has resigned to accept a similar appointment on the Denver & Rio Grande R. R.

WALTER F. RANDALL, of Walton, N. Y., is making surveys for the Canastota, Morrisville & Southern R. R.

W. B. LANDRETH, of Schenectady, N. Y., has been appointed Engineer to the Sewer Commission Amsterdam, N. Y., with a salary of $200 per month Proposals will shortly be advertised for.

COL. JOHN G. BUTLER, of Saquoit, N. Y., has been appointed Secretary and Treasurer of the Syracuse Water-Works Co., in place of E. H. BROWN, resigned.

J. F. GODDARD has been appointed General Manager of the Atchison, Topeka & Santa Fè R. R., and of the Chicago, Kansas & Western R. R. His authority will extend over the Santa Fè branches and over the Southern Kansas R. R.

GEORGE W. CUSHING, formerly Superintendent of Motive Power on the Northern Pacific R. R., has accepted a similar position on the Philadelphia & Reading R. R.

I. WHEDON, Division Superintendent of the Arkansas division of the Missouri Pacific Ry., will take charge of the Little Rock, Mississippi River & Texas R. R., and the Little Rock & Fort Smith R. R., with headquarters at Little Rock, Ark.

Mr. E. L. CORTHELL, late Chief Engineer of the Atlantic & Pacific Ship Railway Co., has associated himself with Mr. GEORGE S. MORISON, under the firm name of Morison & Corthell. They will act as consulting and constructing engineers of bridges, railroads and river and harbor work in the United States and other countries.

GEO. A. KIMBALL, for the past 12 years City Engineer of Somerville, Mass., recently resigned his office, and on Friday evening last, the leading officials and other citizens of Somerville, at a reception given in honor of Mr. KIMBALL at the City Hall, presented him with "a handsome Waltham gold watch, chain and charm, suitably inscribed, from associates and friends." The whole affair was a very pleasing testimonial to the personal popularity of Mr. KIMBALL and to his efficiency as an engineer.

SOCIETY PROCEEDINGS.

THE next meeting of the "Society of Railroad Water Supply Superintendents" will be held on May 12, in Room 3, Union Block Cedar Rapids Iowa, at 10 A. M. The business of this Society is entirely scientific and practical, and correspondence with all in this profession is requested. Address, Sec'y. Soc. R. R. W. S. Supts., 171 South 6th St. Cedar Rapids, Iowa.

Canadian Society of Civil Engineers.—Mr. SHANLY has introduced into the Dominion Legislature a bill to incorporate the Canadian Society of Civil Engineers.

American Society of Civil Engineers.—The regular monthly meeting of the society was held on Wednesday evening, May 4, Prest. WORTHEN in the chair. The Secretary made various announcements in reference to the convention, substantially as we have already reported in our last and present issue. The death, on April 19, 1887, of ALEXANDER MITCHEL, Fellow of the Society, elected June 13, 1883, and late President of the C. M. & St. P. Ry., was announced, and the usual resolution (which, by the way, seems to be more honored in the breach than the observance, as a rule,) was passed in reference to preparing a memorial.

A brief practical paper by J. ALBERT MONROE, of Providence, R. I., on a "Novel Method of Removing Air from a Vertical Bend in a Suction Pipe," was read. The gist of the method was an application of the injector principle by which the air from the summit of the pipe was exhausted by a jet of steam at a considerable distance, a small pipe for this purpose having been tapped into the main pipe at the highest point. The main pipe was of 6 ins. diameter, and the suction pipe of ¾-in. diameter. To this paper there was little discussion.

A specimen of Acquia Creek sandstone showing the action of paint in protecting it. The oil had penetrated about ¼-in., leaving the pigment outside in a solid and durable coat.

A paper "On the Calculation of the Stresses on Bridges for the Actual Concentrated Loads," by Prof. GEORGE F. SWAIN, of the Massachusetts Institute of Technology, was then read, of which the following is an abstract:

In the calculation of the stresses on bridges the loads assumed are either a system of concentrated loads, at certain given distances apart, or a uniform load with a concentrated load over the drivers of the locomotive. The first method of assuming the load has been considered to conform most accurately to the actual conditions of loading, and of late years has been specified by almost all of the leading railroads. It may be doubted however, whether such a loading really is any more accurate than a uniform loading would be, inasmuch as the actual loads passing over a bridge are different with every train, and the weight of engines and cars are constantly varying. The writer is completely in accord with the recent movement towards going back to the method of uniform load with locomotive excess as sufficient in most cases for all practical purposes. Nevertheless the actual loads are still extensively prescribed, and should certainly be used in the calculation of certain portions of the truss. The present paper has for its object to explain in detail the method of finding the loading giving maximum stresses in each member, and of determining those stresses themselves; and the method presented will be found applicable to the solution of many other problems of frequent occurrence, as well as to the calculation of the stresses under the assumption of a uniform loading.

The first point to be discussed is the maximum moment at any point on a beam, and the already well-known theorem is demonstrated, that for the "maximum moment at any point, the average load per running foot on the two sides of the point must be as nearly equal as possible." The application of this theorem to the finding of the maximum moment is illustrated and amplified. The methods of finding the position of loading causing maximum shear at any point are next taken up, and a very simple method of finding these shears explained. A method is then taken up by which moments, shears or stresses may be determined by means of what are called lines of influence, and which, by its perfect generality, allows of the solution of a great variety of problems, both for concentrated and for uniform loads. Considering, for instance, the moment at any given point P, the line of influence for this moment may be defined to be a line whose ordinate at any point Q represents the moment at P due to a load unity acting at Q. By the use of these lines some important theorems are demonstrated regarding the loading causing maximum stresses, and it is shown that in order to find—in the above example, for instance—the moment at P due to a given system of concentrated loads, it is only necessary to multiply each load by the ordinate to the influence line at the point where that load acts, and sum up the results. It is further shown that in order to find the moment at P due to a uniform load g per running foot covering any given portion of the span, it is sufficient to multiply g by the area included between the influence line and the areas of abscissas within the portion of the span covered by the load.

These principles are then applied to finding the maximum stresses in trusses of various forms, in floor beams, floor beam hangers, etc. For double intersection trusses, the best method of solution is believed to be that by influence lines, which, though rather tedious, is perfectly simple, and allows of the exact determination of maximum stresses for the actual loads.

Trusses with curved chords are then considered, and the modifications shown, which are necessary in the application of the preceding principles. A method for calculating the stresses in the diagonals is also given, which consists in finding the horizontal components of the stresses in the chords, the difference of which is the horizontal component of the stress on the diagonal. This method is believed to be rather more expeditious in many cases than the more common one of finding the shear in each frame and subtracting from it the vertical component of the stress in the curved chord.

The stresses, in cantilevers are most simply determined by means of influence lines, which find one of their most beautiful applications in this connection. The forms of the influence lines are such, that the loading causing maximum stresses are found by the same rules as for simple girders, while the maximum stresses themselves are found by a very simple process requiring the use of no formulæ except a few simple arithmetical ones.

For the calculation of continuous girders and draw span, the method of influence lines allows of a simplification of the ordinary methods. In fact, it is a characteristic of the method in all its applications that it enables the computor to see at every point exactly what he is doing, and it renders him almost independent of formulæ. Besides simplifying many of the ordinary methods of calculation, it reduces the liability to error, by rendering the results easy to check, and by showing them to a certain extent graphically.

Without going too much into detail, it is difficult to prepare a satisfactory abstract of this paper. It is hoped that these few lines have given an idea of its character, that those who desire may read it in detail. The full paper is accompanied by many diagrams, and is eminently one which it is impossible to do justice to by abstract without these diagrams. Neither was the paper one of the kind which it is possible to discuss off-hand, without careful study. Therefore, there was little, or no discussion of it. It is expected that the paper will shortly be printed in full, when we shall hope to present it to our readers.

The following members were declared elected on canvass of the ballot:

FOR MEMBERS.

FRANK BRUEN, (Cornell Univ. 1878.) formerly engaged on Dayton and South Eastern Ry.; Dayton, Covington, and Toledo R. R.; Missouri River Construction Work; Assistant Engineer Union Pacific Ry.; Assistant Engineer Maintenance of Way, afterward Resident and then Division Engineer Utah and Northern Branch U. P. Ry.; recently Assistant Engineer Bitter Root and Rocky Mountains, Montana, Ry.; now Civil Engineer, New Haven, Conn.

HENRY MANSON BYLLESBY, formerly engaged in Laboratory of EDWARD WESTON; with ROBERT WETHERILL & Co., Chester, Pa., erecting Corliss Engines and Mill Machinery; in charge of erection large Central Station Plants, Edison Electric Light Co.; Manager Edison Light Companies of Canada; now Vice-President and General Manager Westinghouse Electric Co., Pittsburg, Pa.

SAMUEL BARRETT CUSHING, formerly engaged in charge of Construction South Manchester Branch Hartford and Providence R. R.; East Providence Branch of Providence and Worcester R. R.; recently and now engaged in designing and building wharves, dams and bridges, Providence, R. I.

HERBERT CLARK FELTON, (Rens. Pol., 1866) formerly engaged with Novelty Iron Works, New York City; Assistant Engineer Manchester and Camden and Melford and Camden Railroads in New Jersey; Engineer in charge preliminary Surveys Weehawken Ry.; Chief Engineer New York and Fort Lee R.R.; Engineer Dutchess and Columbia R. R.; Chief Engineer Medford and Camden R. R.; now Secretary, Treasurer and Superintendent Knighnus Point and Philadelphia Ferry Co., Camden, N. J.

SILAS BENT RUSSELL, (Wash. Univ. St. Louis 1881). (Elected Junior June 3, 1884) formerly Assistant Engineer and now Engineer in charge of Water Distribution of St. Louis, Mo.

ROBERT SOMERVILLE, (Univ. Va, 1869) formerly Assistant Engineer Chesapeake and Ohio R. R.; Assistant and afterwards Resident Engineer on Construction Big Sandy R. R. in Kentucky; Assistant Engineer Eastern Extension Chesapeake and Ohio R. R.; recently U. S. Assistant Engineer in charge of Levee Work in Bolivar Co., Miss., now Assistant Engineer Board of Mississippi Levee Commissioners, Greenville, Miss.

WILLIAM PARSONS WATSON, (Yale Coll.) formerly Superintendent Du Pont & Co. Powder Works at Sycamore, Tenn.; in charge for Contractors B Street Outlet Sewer, Washington, D. C.; in charge of Surveys on Rivers and Harbors in Maryland and Virginia under S. Thayer Abert, U. S. Civil Engineer, M. Am. Soc.C.E., Resident Engineer in charge of Construction Northern Pacific R. R.; recently Resident Engineer in charge Location and Construction on Mountain Division Canadian Pacific Ry.; now Resident Engineer in charge of Location and Construction Montana Central Ry., Helena, Montana.

FOR JUNIORS.

BENJAMIN DOUGLAS, formerly Assistant Engineer Detroit Bridge and Iron Works; now Engineer of Bridges, Michigan Central R. R., Detroit, Michigan.

JOSEPH YENDS WHEATLEY, (School of Mines, Columbia Coll., 1886.) formerly Assistant Engineer New York, West Shore and Buffalo Ry.; Assistant Instructor in Surveying at School of Mines, Columbia College; now Assistant in Chief Engineer's Office New York Central and Hudson River R. R., New York City.

Providence, R. I., Street Lights.

THE annual report of the Superintendent of Lights of the City of Providence, R. I., for the year ending Dec. 31, 1886, states that $127,487.06 has been expended for lighting the city. Among the principal items of expenditure we find, for gas, $61,252.65; electric lights, $23,239.20; lamp lighters, $29,103.13; gasoline lamps, $5,727.93, and naptha, $1,651.80. There are at present 2,560 gas lamps, 1,035 naptha lamps, 627 gasoline lamps and 175 electric lights; a total of 4,397.

The force employed includes one superintendent, one man in charge of gas cocks and burners, ($2.25 per day); one man on glass and tin repairs, ($2.25); one teamster, ($1.75), and 63 lamplighters; the latter receive 1½ cts. for lighting and cleaning each gas lamps in charge, and 3 cts. for same work on each naptha lamp.

The gas is supplied by the Providence Gas Co. and is of 18-candle power. The price paid during the year was $1.50 per 1,000 cu. ft., and the amount paid the company was $61,252.65. The price paid for gas is in excess of the Boston rate, ($1.30), and the Pawtucket rate, ($1.35), and the superintendent has reasonable hopes of a reduction in rate.

The price paid for electric lights is 50 cts. for each lamp lighted all and every night. The introduction of this light has not materially decreased the amount paid the gas company in the past 7 years. Complaint is made of the overhead electric wires and some improvement is demanded in the method of attachment.

The Perpetuation of Corners.

At the last annual meeting of the Ill. Soc. of Engineers and Surveyors, Mr. J. S. BURT read a short paper on the above subject. After pointing out the great importance of permanent monuments for both land and town surveying, he suggested a stone 14 to 16 in. long, 4 in. square for 6 in. below the top, and having a pyramidal top.

In the discussion that followed the following methods of marking corners were described:—Mr. ENOS said he generally fixed government corners by taking four bricks and setting the corners together at the point to be marked and setting these 4 ft. below the surface, with a stone above; an iron pin was sometimes set below the bricks. Mr. HILL suggested vitrified sewer-pipe with the hole filled with cinders, where these materials were attainable. Mr. MCCLANAHAN said that his predecessor in office many years ago, punched holes in the ground 4 or 5 ft. deep and 1 in. in diameter and filled the hole with lime of the consistency of cream; Mr. MCCLANAHAN said that these were still the best monuments in that section and that they were practically indestructible.

THE new Thames tunnel, of the City of London & Southwark Subway Co., is progressing at the rate of about 10 ft. per day in each tunnel. There will be two tunnels, as we have before described, and one of these is now about 300 ft. beyond the river on the south side, and the other is half-way over. The *Railway News* says that the finished line of 3¼ miles will be worked by cables on the American plan with American carriages with end entrances. Each train will carry 100 passengers and weigh, loaded, 20 tons, and it is intended to run on two-minute intervals. These trains will be fitted with a "grip" at each end, and at the termini the two tunnels will converge into one bay with two platforms, one for arriving and the other for departing passengers. The trains will evidently be shunted from one line to the other, after a plan similar to that in use on the East River bridge in New York. Two hydraulic lifts, capable of handling 50 passengers at a time, will cover the 50 ft. lying between the train platform and the roadway above.

WHILE the rebellious farmers who lately cut the Paulding Co., Ohio, reservoir banks can not be upheld in law-breaking, it does seem as if the conditions were sufficient to provoke even dynamite. The history in a nut-shell is that an old, leaking canal reservoir, feeding a canal which is unused except by a few lumbermen to float a stray raft upon, has been rendering farming land worthless for years, and presenting a plague-spot in summer that makes the whole neighborhood dangerous. The reservoir covers 2,000 acres of State land, and is said to render 25,000 acres of private lands near it practically worthless. The farmers have plead for years for the abandonment and drainage of this area and have each time been defeated in the Legislature by the lumber-lobby before referred to; and the late outbreak is the simple fruit of desperation and a loss of all faith in State assistance or justice.

THE Cowles Electric Smelting and Aluminum Co., of Cleveland, Ohio, has issued a pamphlet of about 50 pages that contains more information on aluminum and its alloys than we ever saw elsewhere collected.

CONSTRUCTION NEWS.

Water.

Attention is called to our advertisement of back Nos. of ENGINEERING NEWS for 1886. The "News of the Week" columns alone form a very complete record of contract work in every part of the country. *Absolutely every copy* will be disposed of as rapidly as possible, and as soon as the demand ceases the remaining stock will be sold to the junk dealers. It is now or never for those who want any of these numbers.

Mud Pumps.—A test has been made of a new mud pump to be used for pumping up mud and filling in the Potomac flats at Washington, D. C. The machine is for Rittenhouse Moore, Mobile, Ala., who has the contract for filling in the flats.

Steel Water Pipe.—Messrs. Duncan Bros., of London, have had their bid accepted for steel water pipe to be laid on the Tay Bridge. There will be two miles of this pipe; the barrel made of mild steel by the Clyde Tube Works, Coathbridge, England, and the pockets of cast-steel. The total cost of the work, for pipes, sockets and coating is $16,000; the laying is estimated at $2,000 more. No diameter is given.

Gas Works.—Omaha, Neb. The Nebraska & Kansas Gas & Heating Co. has been incorporated by MAX MEYER, CHAS. E. LEE and L. W. HILL. Capital stock, $1,000,000.——Winchester, Ky. Works will be built at once by S. SOLOMON.——Orlando, Fla. Gas works are being built.——Charlottesville, Va. New machinery will be put in at the gas-works.

Buffalo, N. Y.—The Water Commissioners have decided to limit the proposals for pumping engines to engines with a crank and fly-wheel. The Henry R. Worthington Co. has written a letter claiming that this is unfair to the city and to manufacturers, stating that they can supply an engine fulfilling all other requirements of the specification, but will not make engines on the crank and fly-wheel plan. The matter is still in abeyance.

Irrigation.—A large drainage district is under construction in Iroquois county, Ill. Two steam dredges are at work, and in connection with the open ditch work there will be 62 miles of large tiles for mains. The work is in charge of C. G. ELLIOTT, C. E., whose headquarters are at Gilman, Ill.——An irrigation canal, 50 miles long, is projected to bring water from the Colorado and Gila rivers to irrigate about 180,000 acres of land around Yuma, Ariz. The plans have been prepared by G. W. NORTON, C. E.

Water-Works Improvements.—Springfield, Mass. The water supply will be improved by excluding the water of the Belchertown reservoir from the Ludlow reservoir, and turning a new supply into the latter from Ax Factory brook.——New Albany, Ind. The water company will issue 4 per cent. bonds to raise funds for the proposed improvements.——Birmingham, Ala. A reservoir with a capacity of 1,000,000 galls. will be built for the water-works.——Oshkosh, Wis. The water company will adopt a filter system at a cost of $15,000.——Laredo, Tex. The water company has succeeded in laying a 12-in. pipe across the Rio Grande to the island, where a supply will be drawn from creeks.

Albany, N. Y.—The Albany water bill, which was signed by the Governor last week, provides, among other things, that the special water commissioners may alter the original plans, subject to the approval of the Council, that the work may be let without advertising for bids, and that the water commissioners may purchase pumping plant with a daily capacity of 15,000,000 galls. The special water commissioners have held their first meeting under the new law and have decided to lease land for the driven wells and will purchase it if these prove satisfactory. Engineer VERONA, of the city engineer's department, Brooklyn, N. Y., who has previously investigated the water question, has been retained to prepare the plans and estimates for the new service.

Sewerage.—Baltimore, Md. Dr. C. W. CHANDLER, who recently visited Europe to investigate the sewerage question, will report to the Board of Health in favor of the pneumatic system.——Great Barrington, N. Y. It has been decided to raise $6,000 to perfect a system of sewerage, and $200 for surveying and mapping the sewerage system.——Chicago, Ill. The Duffy National Sewerage & Drainage Association has been incorporated by THOMAS H. DUFFY and others, with a capital stock of $200,000.——Marshall, Mo. A sewerage system is to be constructed and M. TUTTLE, of Pike & Tuttle, Kansas City, Mo., has been preparing the designs.——Sherman, Tex. A system of sewerage is contemplated.——Washington, D. C. Work will soon be commenced on the new sewers, $50,000 will be expended this season.——Pensacola, Fla. A sewerage system is to be established.

New Water-Works.—Bar Harbor, Me. The Eden Water Co. has made a proposition to purchase the plant and franchise of the Bar Harbor Water Co.; if this is not accepted a new system will be put in.——Farmington, Me. The proposition of the Farmington Water Co. to put in a first-class water system and provide 35 hydrants for a rental of $1,500 per annum has been rejected.——Albion, N. Y. The Trustees have approved a contract with Bassett Bros., of Buffalo, for a system of 7 miles of pipe with 80 hydrants at a rental of $3,000 per annum.——Bath, N. Y. The Greenbush Water Co. will put in 35 hydrants at a rental of $1,300 per annum.——Haddonfield, N. J. Pipe laying for the new water-works has been commenced.——Hinton, W. Va

The city will issue $10,000 in bonds for water-works. Address Mayor J. PRINCE for particulars.——Decatur, Ala. A proposition has been made by a New York company to establish water-works and supply 5,000,000 galls. per day; it will probably be accepted.——Rochester, Minn. The works are to be completed by July.—— Great Bend, Kan. A franchise has been granted to J. A. JONES of Wichita, Kan.——Pine Bluff, Ark. The St. Louis Water, Light & Power Co. will begin work at once on the water-works, they will cost $155,000.——Tekemah, Neb. Water-works will be established at a cost of $50,000.——Benton, Mont. A system of water-works has been contracted for, to cost $41,000.——Ashland, Ore. Work is progressing on the water-works.——San Francisco, Cal. It is proposed to bring an additional water supply from Tuolumne county, supplying Stockton, Modesto, Oakland and other places along the route.

Hummelstown, Pa. Address J. J. NISSLEY.——Decatur, Ala. Address E. S. SEAMAN.——Wahoo, Neb. Address H. S. DORSEY.——Canton, Mass. ——Washington, Ga.——Gainesville, Ga.——Corunna, Mich. ——Carlinville, Ill.——Stockton, Kan.——Downs, Kan. ——Monticello, Ark.

Binghamton, N. Y.—The Water Commissioners have issued their report for 1886. During the year 10,103 ft. of iron mains have been laid, and 10,753 ft. of old cement pipe have been replaced with iron. The artesian well begun in 1885, was put down to a depth of 1,000 ft., but the supply of water was too small to pay for pumping. To secure an ample supply for cases of emergency a crib has been built in the Susquehanna river and connected with the pump wells by a 30-in. pipe; the crib was built by the local firm of Sullivan & Clark. The Council is asked to appropriate $12,464 for replacing the cement pipes with iron and for extensions. The boilers and machinery are reported to be in good condition. The pipe system comprises 7 mls. 1,793 ft. of cement-lined pipe and 20 mls. 2,322 ft. of iron pipe; the pipe consists of 2-in. wrought-iron and 4, 6, 8, 10, 12, 16 and 20-in. cast-iron. There are now in use 237 hydrants, 278 valves and 174 meters (Crown, Union Rotary, Undine, Gem, Equitable, Ball & Fitts, and Otis elevator). There are two Holly quadruple, compound, condensing engines with a daily capacity of 2,000,000 and 6,000,000 galls. The total consumption for the year, with an estimated population of 22,361, was 897,726,770 galls. The source is from excavated wells and the Susquehanna river, and the supply is on the direct pressure system. The works were built in 1867-68. DARWIN FELTER is the Superintendent.

Northboro, Mass.—The Water Commissioners have submitted their report for the year ending Feb. 18, 1887, being the fifth annual report. The supply has been sufficient, but there has been a disagreeable taste and odor during the warm weather; this is reported to be due to the slopes of the open reservoir being in such condition as to be conducive to the development of vegetable organisms, and it is recommended that the slopes be put in proper order. The works were constructed in 1882 and are owned by the town; the supply is by gravity from a reservoir. There are about 8.75 miles of distribution pipe, 52 gates, 49 post hydrants and four Lowry hydrants. The report quotes the State Board of Health with regard to the pollution of wells and states that the danger lies in the fact that such pollution is not evident to taste or smell but shows itself in some form of disease. SAMUEL SMALL, MILO HILDRETH and G. P. HEATH are the Water Commissioners.

Springfield, Ill.—The Board of Water Commissioners has issued its report for the year ending Feb. 28, 1887, being the twenty-first annual report. The pumping machinery is reported to be in excellent condition. During the year, the compound condensing engine pumped 312,772,814 galls., and the non-condensing engine pumped 396,414,600 galls. The average daily consumption is 2,265,774¼ galls. On account of the long continued low stage of water at the river works a dam had to be built to raise the water 3 ft. higher; it proved an entire success. During the year 12,573 ft. of 3, 4 and 6-in. pipe were laid, nine hydrants put in, 155 connections made and other improvements carried out. The system now includes 27 miles 2,000 ft. of main pipe (five miles of 15-in., 3 miles of 10-in., 5 miles 4,900 ft. of 6-in., 12 miles 2,160 ft. of 4 in., 1,200 ft. of 8-in. and 4,150 ft. of 3-in.), 125 fire hydrants, 41 meters and 1,395 connections. PETER BERRIMAN is Superintendent.

Kingston, Mass.—The Water Commissioners have presented their first annual report, dated March 1, covering the construction and maintenance from their election in November, 1885. The act authorizing waterworks was passed in 1885 and the town issued bonds for $40,000 for their construction. ARTHUR H. HOWLAND, of Boston, was Chief Engineer, with W. C. BOYCE, of Worcester, as Engineer in Charge. The water is taken from a brick lined well, 20 ft. in diameter and 18 ft. deep, which yields about 79,200 gals. per day; from the well the water is pumped into a circular brick reservoir, 50 ft. in diameter and 18 ft. deep, with a capacity of about 265,000 gals.; the bottom is of concrete. The head varies from 92 to 190 ft. The pumping plant consists of a Blake duplex power pump, with cylinders 5-in. by 12-in., capable of pumping 228 gals. of water per minute and driven by a 30-in. Burnham turbine of 17 H. P. The water is reported to be of excellent quality. The system comprises 13,573.64 ft. of 4-in. main, 18,621.07 ft. of 6-in. and 8,738.27 ft. of 8-in., total about 7.75 miles of cast-iron pipe coated with asphalt; there are 50 public and 5 private hydrants, 39 gates, six 4-in. blow-offs for flushing, and two automatic air valves at elevated points on the pipe. The construction was carried out by the Commissioners, the pipe laying, etc., was done by Thos. F. Maney & Co., of Boston; the pipe was furnished by the McNeal Pipe & Foundry Co., Burlington, N. J.; the hydrants and gates by the Coffin Valve Co., Boston; the gate boxes by A. W. Morgan, Buffalo, N. Y.; the lead service pipe by the Chadwick Lead Works; the stop cocks and services by the Walworth Manufacturing Co., Boston, and the pump by the Geo. F. Blake Manufacturing Co., Boston. The water is pumped into the pipes, the surplus passing to the reservoir, which furnishes the supply when the pump is not running. The expenditures for construction, including land, plant, etc., complete, amount to $44,230.89. The Commissioners are JAMES L. HALL, HENRY K. KEITH, and STEPHEN HOLMES. The Superintendent is MELVIN C. FRENCH.

Proposals Open.

Grading.—Grading and leveling the grounds of the company's works at Curtis Bay. HOWARD CARLTON, Manager, South Baltimore Car Works, German and Calvert streets, Baltimore, Md.

Street Material.—Crossing stone, brick, sand, Belgian block, broken stone, gutters, etc. EDWIN S. SMELTZ, Secretary, Street Committee, Lancaster, Pa. May 9.

Street Improvement. — Improving and grading Shelby street. C. M. ALLEN, Jr., City Clerk, Vincennes, Ind. May 9.

Railroad Grading.—From 10 to 30 miles, P. CAMPBELL, Superintendent, Sheffield & Birmingham R. R. Sheffield, Ala. May 10.

Life Saving Stations.—At Beach Haven, N. J., and Portsmouth, N. H. S. I. KIMBALL, General Superintendent, U. S. Life Saving Service, Treasury Department, Washington, D. C. May 10.

City Work.—Iron work of viaduct, paving with pine blocks treated with chloride of zinc, granite block, paving, curbing, grading, etc. HENRY FLAD, President, Board of Public Improvements, St. Louis, Mo. May 10.

Bridges.—Stone bridge over the Wissahickon creek, wooden bridge over the P. & R. R. R. LOUIS WAGNER, Director, Bureau of Surveys, Department of Public Works, Philadelphia, Pa. May 11.

Sewers.—Wooden outlet, 280 ft.; circular 2-ring brick sewer, 4 ft. 7 ins., 400 ft.; 2-ring brick sewer, 3 ft. by 4 ft. 6 ins.; 1,431 ft.; ditto 2 ft. 10 ins. by 4 ft. 3 ins., 466 ft.; ditto 2 ft. 3 ins. by 3 ft. 4 in., 466 ft.; 1 ring ditto, 18 ins. by 27 ins., 466 ft.; 20-in. pipe, 932 ft.; 24-in. pipe in 6 in. Portland cement, 50 ft.; 300 piles; 84,000 ft. B. M. timber; 11 manholes; 10 lampholes; 1 flush tank; 288 inlets; rubble, 600 cu. yds.; earth excavation, 11,000 cu. yds.; rock excavation, 1,200 cu. yds.; sand or beach gravel, 1,500 cu. yds. JAMES FOWLER, City Engineer. GUY WELLS, President, Board of Public Works, Duluth, Minn. May 11.

Street Work.—Constructing Michigan street. Earth excavation, 1,000 cu. yds.; rock excavation, 600 cu. yds.; borrow, 67,900 cu yds.; gravel and rolling, 940 cu. yds. GUY WELLS, (*as above*). May 11.

Sewer.—THE COMMISSIONER OF CITY WORKS, Municipal Building, Brooklyn, N. Y. May 13.

Artesian Well.—At Ensley, Ala.; 10 or 12 ins. diameter, 500 to 1,500 ft. deep. T. T. HILLMAN, Vice President, Tennessee Coal, Iron & Railroad Co., Birmingham, Ala. May 14.

Street Work.—Excavating, filling, forming, curbing and dimension granite block paving. THOS. J. LANAHAN, Clerk of Board of Contract & Apportionment, Albany, N. Y. May 16.

Electric Lighting.—THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers street, New York City. May 16.

Wood Paving.—Excavation, grading, foundation of tarred pine boards on sand, round chestnut block paving, gravel and tar filling. W. J. FLANIGAN, City Clerk, Binghamton, N. Y. May 17.

Paving and Sewers.—Trap block paving. THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers street, New York City. May 19.

Iron and Steel.—For lock gates and filling valves at La Grange lock, Illinois river. Steel, 43,000 pounds; wrought-iron, 17,500 pounds; cast-iron, 110,000 pounds. Major THOS. H. HANDBURY, U. S. Engineer Office, Chicago, Ill. May 20.

Iron Work.—For Pipe Island light house. Major S. M. MANSFIELD, U. S. Light House Engineer (10th and 11th Districts), Detroit, Mich. May 21.

Hospital.—For building the West Tennessee Hospital for the Insane; separate bids for water supply and steam heating. Architects, MCDONALD BROS., Louisville, Ky. AUSTIN MILLER, Chairman of the Asylum Commissioners, Bolivar, Tenn. May 23.

Caisson.—Iron floating gate or caisson for the dry dock at the Boston navy yard. D. B. HARMONY, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C. May 25.

Scales, Sheds, Etc.—Wagon scale, 34 ft. railroad track scale, scale house, sheds and fence. Capt. J. W. JACOBS, Asst. Q. M., U. S. A., Atlanta, Ga. May 26.

Street Work.—Excavating, granite paving, curbing, crossings, etc. THOMAS G. SMITH, President, Board of Public Affairs, Cincinnati, O. May 28.

Sewers.—Trunk sewers and appurtenances, lateral sewers and appurtenances. Separate bids. Plans and specifications at the office of A. S. HOBBY, C. E., Johnston Building, Cincinnati. W. ELLWOOD WYNNE Corporation Clerk of Avondale, Sinton Building, Cincinnati, O. May 30.

Dredging.—In Cheboygan harbor. Lieut. Col. O. M. POE, U. S. Engineer Office, Detroit, Mich. May 31.

Stone.—Marble, blue stone and granite; for terrace and grand stairways. EDWARD CLARK, Architect U. S. Capitol, Washington, D. C. May 31.

Bridge.—Steel, iron or wood, across Brashear's creek; two spans of 63 ft., one of 140 ft., roadway 16 ft.; stone work furnished. GEO. W. ANDERSON, (Bridge Commission), Taylorsville, Ky. June 1.

Capitol.—Iron work, stone work, brick work, and fireproofing for the main building of the Capitol at Topeka, Kan. Architects, MCDONALD BROS., Louisville, Ky. THE SECRETARY OF STATE, Topeka, Kan. June 1.

City Hall.—Competitive designs. ROBERT ALLISION, President, Board of City Hall Trustees, Cincinnati, O. June 1.

Buildings.—Brick barracks and storehouse at Fort Niagara, Youngstown, N. Y. CHAS. H. TOMKINS, Asst. Q. M. Gen., U. S. A., Governor's Island, N. Y. H. June 2.

Penitentiary.—Repairs, estimated cost, $10,000. THE STATE BOARD OF PENITENTIARY COMMISSIONERS, Little Rock, Ark. June 6.

Contracting.

Dredging Appropriation.—The State Senate has passed the bill appropriating $30,000 for deepening the Chautauqua lake outlets.

Pier.—Robert McCarroll has been awarded the contract for building a government pier at Charleston, S. C., for $33,000.

Slag Paving Blocks.—The Pennsylvania Slag Block Co., of Catasauqua, Pa., has a contract for 1,000,000 paving blocks.

Parliament Buildings.—The Ontario Assembly has ratified the contract with Lionel Yorke for the construction of the new Parliament Buildings in Queen's Park, Toronto, at $752,000.

Sewers.—The following proposals were opened May 2 at the Department of Public Works, New York City: (1) On 74th street; Joseph Moore, sewer, $4 per lin. ft.; rock excavation, $4.25 per cu. yd.; timber, $10 per 1,000 ft. B. M.; total, $9,102.50. E. E. DeCamp, $5, $4, $10, $9,470. P. Kearns, $9, $2 50, $42, $10,279. Contract awarded to Joseph Moore.——(2) On 4th avenue; Jos. Moore, pipe sewer, $10 per ft.; timber, $40; total, $1,590. Rejected.——(3) On 76th street. E. E. DeCamp, pipe sewer, $3.50 per ft.; 12-in. culvert, $2.50 per ft.; receiving basins, $2; rock excavation, $4 per cu. yd.; timber, $10; total, $5,975 Pat. Kearns, $8, $4, $1.90, $2, $30, $6,195. Jos. Moore, $5 75. $2.50, $3, $5, $1, $8,162.25. Contract awarded to E. E. DeCamp.

Street Work.—The following proposals for regulating and paving (Nos. 1, 2, 3 with trap block, Nos. 4, 5, 6 with granite block) were opened May 2 at the Department of Public Works, New York City: (1) On Pitt street; Wm. A. Cumming, pavement, $2.23 per sq. yd.; bridge stone, 50 cts. per lin. ft.; total, $9,052.60. Thos. Gearty, $2.37, 50 cts., $9,615.40. P. H. Fitzgerald, $2.37, 90 cts., $9,685.80. Chas. Guidet, $2.64, 70 cts. $10,736. Contract awarded to Wm. A. Cumming.——(2) On Wooster street: Wm. J. Clark, $2.48, 56 cts., $20,071.36. Wm. Kelly, $2.49, 65 cts., $20,216.52. J. B. Devlin, $2.55, 50 cts., $20,582.40. Chas. Guidet, $2.55½, 57 cts., $20,673.28. John G. Smith, $2.67, 60 cts., $21,606.96. Wm. Gearty, $2.87, 57 cts., $23,170.60. Contract awarded to Wm. J. Clark.——(3) On Bank, Renwick and Congress streets; P. H. Fitzgerald, $2.27, 65 cts., $8,598.53. Wm. A. Cumming, $2.36, 59 cts., $8,691.78. Wm. Gearty, $2.43, 50 cts., $9,144.57. Chas. Guidet, $2.64, 65 cts. $9,968 16. Contract awarded to P. H. Fitzgerald.——(4) On 20th and 31st. streets: Wm. Kelly, pavement $2.38, total, $13,009.06. J. B. Devlin, $2.45, $13,391.70. John G. Smith, $2.53, $13,828.98. Chas. Guidet, $2.61¼, $14,299.59. P. H. McCullagh, $2.69, $14,703.54. Contract awarded to Wm. Kelly.——(5) On 38th street: Wm. Kelly, $2.39, $13,063.74. J. B. Devlin, $2.55, $13,938.30, John G. Smith, $2 55, $13,938.30. Chas. Guidet, $2.67½. $14,621.55. P. H. McCullagh, $2.73, $14,922.18. Contract awarded to Wm. Kelly.——(6) On 10th avenue; John G. Smith, pavement, $2.39, bridge stone, 50 cts.; total, $27,488.25. J. B. Devlin, $2.45, 45 cts.; $28,082.20. Chas. Guidet, $2.55¼, 52 cts., $29,363.62. Wm. Kelly, $2.65, 60 cts. $30,548.60. Thos. Gearty, $2.90, 60 cts., $33,348.60. Contract awarded to John G. Smith.

The Milwaukee Bridge & Iron Works Co. has been incorporated at Milwaukee, Wis., by WM. H. KEEPERS and others, with a capital stock of $125,000.

Pipe Laying.—The contract for laying the pipes for the new water-works at Turner's Falls, Mass., has been awarded to C. H. Eglee, of Flushing, N. Y., and work has been commenced.

Road Roller.—The City Council of Little Rock, Ark., has passed an ordinance for the purchase of an Aveling & Porter road roller. FRED J. H. RICKON, City Engineer.

Siskiyou Tunnel.—The contract for the Siskiyou tunnel and approaches on the extension of the Oregon & California R. R., has been awarded to Hale & Smith, who have contracts on the Cascade division of the Northern Pacific R. R.

Mississippi River Improvement.—The following proposals were opened April 29 by Major A. MACKENZIE, U. S. Engineer Office, Rock Island, Ill.: For dams and shore protection between Homer and Queen's Bluff, Minn.; Jacob Richtman, Fountain City, Wis.; rock in place, $1.53 per cu. yd.; brush in place, 72 cts. per cu. yd.; total, $20,952. A. Kirchner & L. D. Van Gorder, Fountain City, Wis.; $1.40, $1, $21,560. A. J. Whitney, Rock Island, Ill.; $1.59, 75 cts., $21,786. Sid. J. Truax, Hastings, Minn.; $1.48, $1, $22,392. Samuel McDonald, Casselton, Dak.; $1.48, $1.06½, $22,847. Contract awarded to Jacob Richtman.——For dams and shore protections between Guttenberg and Waupeton, Ia.; Sid. J. Truax, Hastings, Minn.; $1, $1, $13,500. Jacob Richtman, Fountain City, Wis.; $1.35, 63 cts., $14,985. A. J. Whitney, Rock Island, Ill.; $1.39, 70 cts., $15,660. John Specht, Dubuque, Ia.; $1.49, 79 cts., $16,965. Samuel McDonald, Casselton, Dak.; $1.45, $1.06½, $17,842.50. Patterson Bros., Keokuk, Ia.; $1.60, 80 cts.; $18,000. Contract awarded to Sid. J. Truax.——For dams and shore protection between Sand Prairie and Savannah, Ill.; A. J. Whitney, $1.30, 70 cts., $21,930. Jacob Richtman, $1.35, 63 cts., $21,969. Sid. J. Truax, $1.25, $1, $23,800. Patterson Bros., $1.50, 75 cts., $24,825. Samuel McDonald, $1.65, $1.25, $30,835. Contract awarded to A. J. Whitney.

For riprap rock at Alma, Wis.: D. Keleher, Davenport, Ia.; 80 cts. per cu. yd., $12,000. N. Martin, Hastings, Minn.; 85 cts., $12,750. A. Kirchner, Fountain City, Wis.; 87 cts., $13,050. Prince, Vanderbilt & Bright, Lynxville, Wis.; $1, $15,000. Samuel McDonald, Casselton, Dak.; $1.25, $18,750. Wm. Witte, Read's Landing, Minn.; 52.7 cts. (for 1,422 yds. only). All bids rejected.——For riprap rock between Fountain City, Wis., and Winona, Minn.; A. Kirchner & L. D. Van Gorder, 75 cts., $7,500. D. Keleher, 95 cts., $9,503. Samuel McDonald, $1.25, $12,500. Contract awarded to Kirchner & Van Gorder.——For riprap rock between Burlington and Montrose, Ia.; Wm. Roberts & Co., Nauvoo, Ill.; 48 cts., $4,800. D. Keleher, 90 cts., $9,000. Samuel McDonald $1.25, $12,500. Contract awarded to Wm. Roberts & Co.

Railroad Contracts.—J. H. McCarthy & Co., of Little Rock, and M. Cameron, have the contracts for the 100 mile extension of the Little Rock & Fort Smith Ry., through the Indian Territory.

Contractor Freeland has commenced work on the West Virginia R. R., from the Pennsylvania State line at the Cheat river to Newburg on the main line of the Baltimore & Ohio R. R.

R. A. Malone & Co., of Lancaster, Pa., have the contract for grading for the four tracks of the Consolidated road to Rye, N. Y. Work to be completed by November.

Shepard, Winston & Co. have the contract for building the Moorhead & Southeastern R. R., between Moorhead and Wahpeton, Minn., and have taken up their headquarters at the former place.

B. F. Johnson & Co., Columbus, O., and J. S. Casement, Painesville, O., are the contractors for the Chautauqua Lake Ry.; 46 miles.

Maginnis & White have the contract for the Perry County R. R. from New Bloomfield to Duncannon, Pa.; 11 miles.

Langdon Bros., of Minneapolis, Minn., have the contract for grading the Aberdeen, Bismarck & Northwestern R. R., from Bismarck to Napoleon, 60 miles.

H. S. Perkins, of Dunham, Ala., has the contract for grading the extension of the East Alabama R. R., to Roanoke, 17 miles. R. J. Trambell, of Opelika, has the contract for bridges and ties.

G. W. Hunt has completed his contract on the Cascade division of the Northern Pacific R. R.

Contracts for grading the Denver and Rio Grande R. R. from Glenwood to Aspen, Col., will be awarded shortly.

A construction company to build the Macon & Florida Air Line R. R., has been organized at Macon, Ga., by K. J. LAMAR, W. W. COLLINS, and others. Capital stock, $500,000.

The Troy & Tiptonville R. R., from Troy, Tenn., to Tiptonville, Miss., is under contract.

Contracts have been let by E. A. GARVEY, Chief Engineer of the Texas & Pacific R. R., for repairing the grade and widening the embankment east from Big Springs to Fort Worth, Tex., and from Marshall to Texarkana.

New Croton Aqueduct.—The following proposals for the construction of Additional Shaft No. 13½, on Section 7, were opened April 22 by the Aqueduct Commissioners, New York City:

			Knapp & Egleston.		O'Brien & Clark.		Engineer's Estimate.	
Shaft excavation	125	lin. ft.	$125.00	$15,625.00	$140.00	$17,500	$150.00	$18,750.00
Brick masonry for shaft lining and arches	200	cu. yds.	11.00	2,200.00	11.00	2,200	10.00	2,000.00
Concrete masonry (5 stone: 1 cement)	100	" "	5.00	500.00	5.00	500	5.00	500.00
Concrete masonry (3 stone: 1 cement)	75	" "	4.50	337.50	6.00	450	5.50	412.50
Rubble stone masonry	15	" "	5.00	75.00	5.00	75	5.00	75.00
Shaft filling	475	" "	.50	237.50	.40	190	.40	190.00
Cut stone (granite) masonry laid	10	" "	40.00	400.00	40.00	400	40.00	400.00
				$19,375.00		$21,315		$22,327.50

Pipe.—Dennis Long & Co., of Louisville, Ky., have been awarded a contract for 19 tons of 8 in. and 268 tons of 24-in. water pipe for Nashville, Tenn.

Stone Work.—The contract for the stone work for the new approaches to the union depot at Hartford, Conn., has been awarded to M. Beatty, of Leete's Island, Conn. Work will be commenced at once on the retaining walls.

The Chicago Forge & Bolt Co's works at Chicago, Ill., were burnt down on May 2, and nearly all the machinery was ruined. The loss is established at $125,000. The establishment was formerly known as the American Bridge Works.

Street Grading.—The following proposals were opened April 23 by J. E. HOUSE, Chairman, Board of Public Works, Omaha, Neb.: E. Callahan, grading streets, 17.9 and 18.9 cts.; grading alleys, 25 cts. Josiah Kent, 22 and 22½ cts.; no bid. C. F. Williams, 20 and 21 cts., 25 cts.

Dredge Boat.—The following proposals for the construction of a dredge boat hull and cabin were opened April 27 by Lieut. Col. J. W. BARLOW, U. S. Engineer Office, Chattanooga, Tenn.: A. R. Perry, Chattanooga, $2,800; M. A. Sweeney & Bro., Jeffersonville, Ind., $5,185.60. The contract was awarded to A. R. Perry.

Tunneling Plant.—Messrs. R. P. McCormick & Co., of Kansas City, Mo., who have the contract for the double-track railroad tunnel, 1,000 ft. long, at that city, have awarded to the Ingersoll Rock Drill Co., of New York, a contract for a complete plant of machinery: 1 "straight line" air compressor, 1 air receiver, 7 Ingersoll tunneling drills, with columns, mountings, etc., boilers, etc. The tunnel is to be completed in 90 days.

Electric Cables and Appliances.——The following proposals for furnishing and laying about 74,000 ft. of conductor in Waring anti-induction cables, extra insulation No. 14, with necessary boxes, connections, etc., ready for use, were opened May 2 by WILLIAM LUDLOW, Engineer Commissioner, Washington, D. C.: Standard Underground Cable Co., Pittsburg, Pa.; $7,476; Royce & Marean, Washington, D. C., $7,900.

Jails.—The contract for the iron work for the new jail at Rochester, Minn., has been awarded to J. H. Van Dorn, of Cleveland, O., at $7,250. The contract for erecting the building was awarded to Granville Woodworth, of Rochester, at $12,125.——The contract for the construction of the new jail at Henderson, Tex., has been awarded to the Pauly Jail & Manufacturing Co., (S. Pickens, Palestine, Tex., agent).

Toronto, Canada, Improvements.—The Committee on Works, under date of April 20, recommended the building of various sewers and laying of street pavements. Bids were opened for cedar pavement, 93 cts. to $1 per sq. yd.; cobble pavement, $1.15 to $1.43 per sq. yd.; curbing, 22 cts. to 24 cts. per lin. ft. The City Treasurer is requested to provide funds for the following works as "interim appropriations":—Sewers, $16,830 and block pavement, $91,500.

Sewerage.—The following proposals for the construction of Section A of the Waring system of sewerage, were opened April 30 by the Board of Street, Sewer and Drain Commissioners, Norfolk, Va.: H. R. Hill, Williamsport, Pa.: Pipe and laying, 150 ft. of 15-in., $2.95 per ft.; 725 ft. of 12-in., $2.70; 1,550 ft. of 10-in., $2; 3,600 ft. of 8-in., 98 cts. for 2,875 ft., and $1.80 for 725 ft.; 9,000 ft. of 6-in., 87 cts.; 16,000 ft. of 4-in., 40 cts.; 600 ft. of 13-in. cast-iron siphon, $3.67; 22 Field's automatic flush tanks, $53; 15 manholes, $32. Jos. J. Lawler, Norfolk, Va.: $2.95, $2.80, $2.40, $1.25, 90 cts., 35 cts., $5, $53, $54. Daniel Molony, $5.90, $5.70, $5, $2.80, $1.08, 20 cts., $5, $38, $25. W. T. BROOKE is City Engineer.

Water-Works.—The following contracts have been awarded by HARVEY R. HARRIS, President of the Water Board, Michigan City, Ind.: Pipe; Dennis Long & Co., Louisville, Ky., $3,000. Building, well, reservoir, etc.; J. Ravell, Michigan City, $7,720.50. Boilers and fronts; Jonathan Mathews, South Bend, Ind., $1,525. All proposals for pumps were rejected and new proposals will be advertised for.

Only one proposal was received by J. F. KINNEY, U. S. Indian Agent, Greenwood, Dak., for supplying the Yankton Agency with water. The contract was not awarded.

The Solid Rock Asphalt Co. has been incorporated at Camden, N. J., by THOS. T. TASKER and others, with a capital stock of $500,000.

Dredging, Etc.—The following proposal for improving Buffalo bayou was opened April 23 by Major O. H. ERNST, U. S. Engineer Office, Galveston, Tex.: J. J. ATKINSON, Houston, Tex.: dredging under water, 22 cts. per cu. yd.; dredging and scraping above water, 20 cts. per cu. yd.; removing sunken logs, 5 cts. per cu. ft.; removing overhanging trees, 4 cts. per cu. yd.; removing stumps as required, at actual cost. Total, $13,600. The contract has been awarded.

Sand and Gravel.—Proposals were opened April 25 by JOHN W. MCDONALD, Superintendent of Streets, Boston, Mass. Unscreened gravel, screened gravel, sand; J. K. Kelly, from 70, 70 and 87½ cts. to $1, for single loads, and from $1.40, $1.40, $1.75 to $2 for double loads. Geo. H. Keyes, 90 cts., $1.05, 90 cts. for single; $1.80, $2.10, $1.75 for double. Owen Nawn, from 67, 70 and 90 cts. to 95, 90 and $1 for single, and from $1.35, $1.39, $1.80 to $1.90, $1.80, $2 for double. Jas. McGovern, 67, 77, 85 cts. and 90, $1.05, 90 for single; and $1.27, $1.46, $1.62 and $1.80, $2, $1.75 for double. Patrick Hart, 75, 80, 80 cts. for single, $1.25, $1.40, $1.40 for double. Wm. Finneran, (gravel only,) 85 and 90 cts. for single, $1.70, $1.80 for double loads.——Beach gravel; Brown & McIntosh, 65½ cts. per ton; Boynton Bros., 67½ cts.——Newburyport sand; James Brown, 78 cts. per ton; Cawley & O'Connor, 80 cts.

Dredging.—The following proposals for dredging were opened April 30 by Major JARED A. SMITH, U. S. Engineer Office, Portland, Me.: In Lubec channel, Me.; Moore & Wright, Portland, 35 cts. per cu. yd., measured in the scow.——In Narraguagus river, Me.: Moore & Wright, Portland, 16 cts. per cu. yd.; Thomas Symonds, Leominster, Mass., 20 cts.; Hamilton & Sawyer, Chebeague, Me., 27 cts.— In Penobscot river, near Bangor, Me.; Moore & Wright, Portland, 23 cts. per cu. yd.; for large rocks, $10 per cu. yd.; Boynton Bros., Boston, Mass., 35 cts.——In Little Harbor, N. H.; Moore & Wright, Portland, 24 cts. per cu. yd.; Thomas Symonds, Leominster, Mass., 25 cts.; Boynton Bros., Boston, Mass., 33 cts.; New England Dredging Co., Boston, Mass., 41 cts.——All four contracts were awarded to Moore & Wright, of Portland.

Bridges, Canals, Etc.

Bridge Notes.—(*Maine*). The Maine Central R. R. Co. will replace the seven or eight wooden bridges between Waterville and Bangor with iron bridges.——(*Massachusetts*). New Bedford. The Old Colony R. R. Co. will replace its wooden bridge at Herring's weir with an iron bridge.——(*Rhode Island*). The town of Warwick will build an iron highway bridge with a span of 100 ft., and the towns of Warwick and Cranston jointly will build a bridge of 150 ft. span. HERBERT B. BARTON, of Centerville, is engineer for Warwick.——(*New York*). Brooklyn. A bridge is to be built over Newtown creek by Kings and Queens counties at a cost not exceeding $25,000; it will be 30 ft. wide and will have a 50 ft. draw.——Fishkill. The New England R. R. Co. is replacing its wooden bridge at Denning's Point with an iron bridge.——Lansingburg. A bridge is proposed over the Troy & Boston R. R., to cost $50,000.——Fonda. An iron bridge is to be built across Cayadutta creek to replace the one washed out.——(*Pennsylvania*). A bridge is to be built over the Schuylkill river at Pottstown Landing.——Monongahela City. A bridge is to be built across the river.——(*District of Columbia*). Washington. Plans for the bridge over the Eastern branch are being prepared by Col. HAINS; the appropriation is $110,000.——(*West Virginia*). The contractors will soon begin work on the railroad bridges at Point Pleasant and Charleston.——(*Tennessee*). Memphis. The bridge across the Mississippi will be built this year; the franchise is held by W. G. FORD, of New York.——Knoxville. A bridge is to be built over the railroad.——(*Kentucky*). Jeffersonville. The site for the bridge across the Ohio river has been surveyed by Prof. J. J. JOHNSON; the distance is estimated at 2,078 ft.——(*North Carolina*). Wilmington. An iron bridge is to be built over the railroad at a cost of $13,000; span, 141 ft.——(*Alabama*). Mobile. The Jackson bridge is being pushed by the contractor, G. L. PUTMAN.——(*Florida*). Palatka. A railroad bridge will be built across the St. John's river.

(*Ohio*). Dayton. Bridge bonds for $22,000 were sold last week.—(*Indiana*). Adams. The Cincinnati, Indianapolis, St. Louis & Chicago R. R. Co. will build a steel bridge of 160 ft. span.—(*Illinois*) Chicago. The swing bridge at 18th street will soon be commenced. —Cairo. The Illinois Central R. R. Co. has let a contract for a steel bridge for $3,500,000.—(*Iowa*). Dubuque. A new bridge will be built by the Minnesota & Northwestern and Chicago, Burlington & Northern railroad companies.—Council Bluff. Surveys are in progress for the new wagon bridge across the Missouri. —(*Minnesota*). St. Hilaire. The contract for an iron bridge across Red Lake river has been awarded to a Minneapolis firm at $5,000.—(*Missouri*). Kansas City. The Wyandotte & Northwestern R. R. Co. is surveying for its bridge across the Kaw river. Another bridge will be built by W. E. WINNER.—(*Arkansas*) Fort Smith. A railroad and wagon bridge is to be built across the Arkansas river for the Kansas & Arkansas Valley R. R.—(*Washington Territory*). Pasco. The Northern Pacific R. R. Co. will build a cantilever bridge over the Columbia river.—(*Canada*) Ottawa. New bridges will be built across the Rideau and Ottawa rivers; a swing bridge will be built over the Rideau.

Railroads.

Canadian Pacific Railway.—The annual report of the Minister of Railways states that the connection between the Dominion Government and the Canadian Pacific Railway Co. has been formally severed. The road is purely the property of the company from Port Moody to Quebec, 3,037 miles. The Dominion subsidy of $25,000,000 in cash and 25,000,000 acres of land was duly paid over to the company as it was earned, in addition to loans. All loans have been repaid by the company, but the repayment of $10,000,000 of the last loan of $30,000,000 was in the shape of 7,000,000 acres of land. The Dominion, therefore, practically has a complete road from the Atlantic to the Pacific at a cost of $35,000,000 worth of work done on the road before it was given to the Canadian Pacific Railway syndicate, $35,000,000 in cash, and 18,000,000 acres of land.

New Companies and Projects.—*East of Chicago.* —The Canadian Parliament has under consideration bills to incorporate the following railway companies: Emerson & Northwestern; Goderich & Canadian Pacific; Kincardine & Teeswater; Brandon, Louris & Rock Lake. There are also bills to amend the charters of the Brantford, Waterloo & Lake Erie Ry. Co., and the Ontario & Quebec Ry. Co.—Somerset Ry. This Maine company is to be reorganized May 11, and the question of extending the line from Anson to Bingham, 17 miles, will then be considered.—Baltimore & Western Ry. Co. Incorporated by STEPHEN B. ELKINS, and others to build a line from Cumberland, Md., to Hagerstown *via* Hancock. The connections at Hagerstown will be with the Western Maryland and Cumberland Valley roads, and at Cumberland with the new Piedmont & Cumberland Ry. There will be two 1,200-ft. tunnels on the line.—The Cleveland & Southern R. R. and Cleveland Belt Line Ry., are two schemes proposed at Cleveland, O.—A line is proposed from Port Jervis, Orange Co., N. Y., to Kingston. If built it will probably be as an extension of the Port Jervis & Monticello R. R.—Binghamton & Williamsport Ry. Jos. P. NOYES, Binghamton, N. Y., is interested.—Terre Haute & Mississippi River Ry. Co. Organized at Terre Haute, Ind., to build a line to the Mississippi river near Grand Tower, Mo.

Southern.—Carolina, Knoxville & Western R. R. Co. Organized at Knoxville, Tenn., to build a line from Port Royal, S. C., to Knoxville, *via* Augusta, Ga. C. PHINIZY, of Augusta, is President.—Gallatin, Murfreesboro, Florence, & Sheffield R. R Co. Organized at Florence, Ala. E. A. O'NEAL is President.—Tennessee & North Carolina R. R. Co. The Virginia Senate has passed a bill authorizing this company to build lines to any mines in Washington, Smyth and Grayson counties.

The Northwest.—Missouri Pacific Ry. A line from Talmage, Nuckolls Co., Neb., to Hastings, will be built if Adams county accepts the company's proposition.—Park Point Terminal & Transfer Co. Incorporated at Duluth, Minn., by R. W. PETRE, and others.—St. Paul, Minneapolis & Manitoba. It is reported that a line will be built this season from Willmar, Minn., to Sioux Falls, Dak.—It is said that a line will be built from Brockton, Ill., on the Danville, Olney & Ohio River R. R., to a connection with the Illinois Central R. R.—The latest Santa Fé rumor, and rumor only, is an extension to Omaha, Neb.

The Southwest.—Little Rock Belt Ry. Co. Incorporated at Little Rock, Ark., by J. B. JONES, and others.—It is now said that the projected line east from Ottawa, Kan., will be known as the Missouri, Kansas & Western R. R., and will be built to Versailles, Mo., where it will connect with the St. Louis, Kansas City & Colorado.—A line is proposed from El Dorado Springs to Nevada, Mo., 20 miles. Col. EDWARD BROWN of Girard, Kan., is interested.—At Mount Pleasant, Tex., funds are being raised for a line to Paris.—Dallas & Archer Coal and Iron Ry. GEO. F. ALFORD, Dallas, Tex., is interested.—Gulf, Colorado & Santa Fé Ry. Decatur, Tex., wishes a branch to be built from Gainesville.

Rocky Mountain and Pacific.—Helena, Boulder & Madison Ry, Co., and Helena, Gallatin & National Park Ry, Co., are the names of two new Montana companies in which Hon. S. T. HAUSER is interested. It is said that surveyors are already in the field.—Denver, Utah & Pacific Ry. A direct line from Denver to Laramie City, Wyo., is to be formed by the extension of this road *via* Fort Collins.—Northern Colorado Ry. Co. Organized at Greeley, Col., to build lines of railway from Greeley to Longmont and Denver, to Hudson, to Orchard, and two lines running north and northwest from Greeley. JOHN M. WALLACE is interested.—A suburban line is proposed at Portland, Ore., between East Portland and Mount Tabor.—Denver & Rio Grande R. R. A Pacific extension is rumored and it is also said that the Texas, Santa Fé & Northern Ry. will be absorbed and extended to Albuquerque, N. M.

Surveys.—*East of Chicago.*—Maine Shore Line R. R. The route for the extension of the road as originally projected is being examined by a surveying party.—Canastota, Morrisville & Southern R. R. The survey has begun.—The proposed line from Bloomville to Delhi, N. Y., is being located. Major CONNELL, Kingston, N. Y. is interested.—New York Central R. R. Right of way is secured for the line from Lewiston to Youngstown, N. Y.—Columbus, Lima & Northwestern R. R. Two parties are in the field running preliminary lines, Messrs. J. F. THOMAS and J. C. MCCULLOUGH are in charge of the work.

Southern.—Carolina, Cumberland & Chicago R. R. Co. R. E. BOWEN, Pickens, S. C., is President. It is reported that a preliminary survey has begun.—Chesapeake & Nashville R. R. A line has been surveyed from Gallatin to Lewiston, Tenn., *via* Murfreesboro, and a further extension to Sheffield, Ala., is under consideration.—Tombigbee R. R. Columbus, Miss., has voted $160,000 of bonds to aid in the construction, which begins at once. —Macon & Tuskaloosa R. R. H. P. FARRAR, Chief Engineer, has completed the locating survey. The line is 66 miles in length, and work and grades are light.—Georgia, Carolina & Northern R. R. The right of way through Georgia has been mostly secured.

The Northwest.—St. Paul, Minneapolis & Manitoba R. R. The surveyors are at work on a line from Milaca Minn., to Brainerd. It is possible that the line may eventually be built to Crookston.

The Southwest.—San Antonio & Aransas Pass Ry. The preliminary survey is completed for the Waco branch. The line was run from Bennet *via* Schulenburg, La Grange and Rockdale to Waco, 170 miles.—St. Louis & San Francisco. The Texas line between Paris and Roberts is located.—Kansas City, Fort Scott & Gulf. The line between Minden and Carthage, Mo., has been surveyed by two different routes.—Missouri Pacific Ry. The Jefferson City & Southwestern line has been located. It is to run from Aurora Springs, Mo., to Carthage *via* Golden City, Stockton, Hermitage, and the Indian creek valley. The preliminary survey of the Arkansas line between Little Rock and Fort Smith has been completed and the line will be placed under construction as fast as located. This line, the Kansas & Arkansas Valley Ry. and the little Rock Junction Ry., have been formally placed under the control of the Missouri Pacific Company.—Fort Smith Paris, & Dardanelle R. R. The preliminary survey is completed and locating parties are in the field.—Missouri, Kansas & Nebraska Ry. The survey has begun on this line, which is to run from Rich Hill, Mo., to Hiawatha, Kan., *via* Paola and Lawrence.

Rocky Mountain and Pacific.—Chicago, Rock Island, & Pacific Ry. The new line to Denver, will be built due west from Horton, Kan., through the northern tier of Kansas counties.—Union Pacific Ry. A line is under survey from Lewiston, Idaho, to Ainsworth, W. T., and from Weiser, Idaho, down Snake river valley.—The new line from Pomona to Elsinore Cal., is under survey.

Grading and Tracklaying.—*East of Chicago.*—Central Massachusetts R. R. Tracklaying has begun at Barre Plains, Mass.—Meriden and Cromwell R. R. Work will begin at once on the extension to Waterbury, Ct., that city having subscribed $125,000, the sum demanded.—Ridgefield & New York R. R. The directors have voted to nullify the construction contracts if work is not begun by May 21, and let the work to other parties. ELLWOOD BURDSALL, Port Chester, N. Y., is President.—Petroleum R. R. This line, which twelve years ago was projected and partly graded from Titusville to Erie, Pa., is to be completed this season. LEWIS F. WATSON, Warren, Pa., is actively interested; and the line when built will form part of the Erie system. —Ohio & Mississippi Ry. Grading is going on at New Albany, Ind.—Kalamazoo & Hastings Ry. Tracklaying has begun on this Michigan road.—Chautauqua Lake Ry. Grading is to be completed by July 1, and it is expected that tracklaying, which began this week, will be far enough advanced that a portion of the road may be opened for traffic at the same time. The line is carried over Chautauqua creek by an iron trestle 480 ft. long and with a maximum depth of 130 ft. J. C. WILLIAMS, Jamestown, N. Y., is Vice President and General Manager.—Midland Ry. of Indiana. The line was opened for traffic May 2 to Lebanon, 44 miles from Anderson, and will be extended at once via New Ross Ladoga and Waveland. H. MOORE, Anderson, Ind., is General Superintendent and E. B. COTTINGHAM is Chief Engineer.—Perry County R. R. This line, 11 miles in length, from New Bloomfield, Pa., to Duncannon, is to be graded ready for tracklaying by Sept. 15, and to open for business by Nov. 1. FRANK MORTIMER, is the President.—Cincinnati, Jackson & Mackinaw R. R. The line from Cecil, O., to Jackson, Mich., 80 miles, is being rapidly pushed by the Ohio Construction Co. Tracklaying will begin next month and is to be finished by November. The Maumee river is crossed by a bridge 390 ft. in length. The southern extension from Manchester, O., on which 26 miles of track were laid last year, will be completed this month to Carlisle, on the Cincinnati, Hamilton & Dayton R. R.

Southern.—Rome & Decatur R. R. The line between Attala and Gadsden, Ala., was opened for business on May 2.—Georgia, Carolina & Northern R. R. Grading has begun on this line, which is now located from Monroe, N. C., to Atlanta, Ga.—Gulf & Ship Island Ry., 150 additional hands have been set at work grading near Hattiesburgh, Miss.—Ohio Valley R. R. On the extension to Princeton, Ky., track is now laid to Marion. —Georgia Midland & Gulf R. R. The track has reached Flint river and will not be laid farther till the erection of the iron bridge at that point.—Pennsylvania R. R. Grading is in progress on the line from the mouth of the Cheat river to Newburgh, W. Va., on the Baltimore & Ohio Ry.

The Northwest.—Minneapolis, Sault Ste. Marie & Atlantic Ry. Laborers are in great demand on this line, and the contractors are importing them from the East. The company will build five large docks at Sanders Point, on Lake Michigan.—Aberdeen, Bismarck & Northwestern Ry. Grading is progressing between Aberdeen and Napoleon, Dak.

The Southwest.—Denver, Texas & Gulf R. R Rapid progress is being made on the line through the Texas Panhandle. Track is laid nearly 250 miles from Fort Worth and advances at a rate of a mile and a half per day. On the Colorado end surveyors are locating the line.—Chicago, Fort Scott & Texas R. R. The managers promise that grading shall begin at once on this line which is to run from Higginsville, Mo., to Arkansas City, Kan.—St. Louis & San Francisco Ry. The line between Fort Smith, Ark., and Paris, Texas, will be completed by the last of this month. Work has begun on the Hackett City & Little Rock line.—Kansas City Belt Ry. $1,000,000 is to be expended on improvements of this line.

Rocky Mountain and Pacific.—Colorado Midland Ry., Notwithstanding the difficult and expensive work which has been necessary in building this line through the rugged country which it traverses, rapid progress has been made, and it is expected to open the line from Colorado Springs to Leadville on July 4. The heaviest grade is 211 ft. per mile, at Cascade Canon, and the greatest elevation is on Hayden's Divide, 9,236 ft. above sea level.—Missouri Pacific Ry. Pueblo, Col., has accepted the company's proposition and the line will be built to that city at once from the terminus of the Kansas & Colorado line in Greeley Co., Kansas.—Denver & Santa Fe Ry. Grading is in progress between Pueblo and Denver near Monument, and also near Colorado Springs. The Golden & South Platte Ry., and the Denver Circle R. R., have been acquired by the Santa Fé and will be completed. A line is also to be built to Canon City. In Southern California the Santa Fé system has consolidated its lines as the California Central R. R., which, at the rate at which projects and extensions are now being pushed, will soon become a railway system of considerable magnitude by itself.—Union Pacific Ry. A contract has been closed with the Chicago, Burlington & Quincy to build a joint line to Glenwood Springs, Colo., via Gore and Cottonwood canons and Grand river, about 75 miles. The Cheyenne & Northern line will be finished to the Platte river by Sept. 1.—Northern Pacific R. R. The Spokane & Palouse line between Belmont, W. T., and Genesee, Idaho, is under construction all along the line. It is expected to complete it by Sept. 1.

Chicago, Madison & Northern R. R.—Ryan & McDonald have the contract for building the line from Fox river west to Freeport, Ill., and work is progressing rapidly. This portion of the work is quite heavy, and several steam shovels are in use. W. G. Dorwin & Co. have the contract for 18 miles from Fox river east to Emhurst, Ill. They will put 3 shovels in operation. The company is building the substructure of the Fox river bridge, consisting of 2 abutments and 5 piers, the foundations will rest on piling. The superstructure is now on the ground and was built by the Union Bridge Co. There are 6 spans of 90 ft. riveted connections, and a deck span. The bridge is about 540 ft long and 40 ft. above the water. Work is being pushed rapidly. ISHAM RANDOLPH is Chief Engineer.